Industrial QUALITY CONTROL

Vol. XIV, No. 3
September, 1957

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The Post Office Uses SQC

Modified Control Charts

Argus Cameras Are Using Sequential Sampling

Annual Society Report

QUALITY
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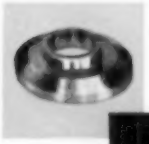

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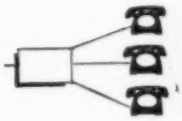

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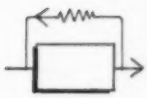

Negative feedback amplifier. Provides distortionless and stable amplification. Made possible the enormous, precisely controlled amplification needed in long distance telephone calls. The principle is now basic in high-quality amplifiers for radio, TV and high-fidelity reproduction.

Quartz crystal. Standard super-accurate quartz crystal oscillator developed for frequency controls in radio telephony. Has also become the standard control for clocks in world's astronomical laboratories.

Coaxial cable system. Hollow tube with a central conductor was developed to transmit hundreds of voices simultaneously. Now also provides long distance carrier for TV in partnership with microwave beams.

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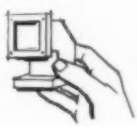

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Quality Control

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From the President's Desk

Where Are We Going?

Every business or group engaged in a common endeavor should make an effort to state its aims, chart its course, and measure its progress. The Society's basic objectives are outlined in the Constitution and the Articles of Incorporation. A review of these will show them to be quite satisfactory and still pertinent.

Article I, Section 1 reads:

b. The purposes of this Society shall be:
(1) To create, promote and stimulate interest in the advancement and diffusion of knowledge of the science of quality control and of its application to industrial processes;
(2) To promote unity and effectiveness of effort among all those who are devoting themselves to quality control;
(3) To provide, through necessary and convenient facilities for the holding of conferences, conventions, and other meetings of its members, for the exchange of ideas and experience in the application and use of quality control, and otherwise to promote the purposes aforesaid;
(4) To publish and distribute books, pamphlets, periodicals, literature and other printed matter devoted wholly or mainly to quality control, with the object of promoting and accomplishing its purposes aforesaid;
(5) To make available to journals, newspapers and other channels of public information, reliable communications and other information concerning quality control and its progress;
(6) To engage in any other activities which are or shall be not inconsistent with, contrary to or prohibited by law, necessary and convenient for the purpose of performing, carrying out, promoting or accomplishing its purposes aforesaid.

Objectives, which are general and long range, should be translated into goals, which are more specific, and programs which are measurable and which can be reviewed at regular intervals.

What goals then, have we set for 1957-58, which will implement our basic objectives?

1) *Stimulate upper-level management interest in, and appreciation of, statistical quality control.*

Several Sections have embarked on a program to conduct a local management conference which will be led and attended by top-management people. We hope to have ten of these meetings this fiscal year.

2) *Promote unity and effectiveness of effort among quality control people.*

These programs are started:

a) Increase membership to 11,500 by June 1958.
b) Improve the efficiency of the headquarters office; specifically, reduce tabulating service costs by 15 percent or more.
c) Improve services to local sections by such means as low cost mailing lists and labels, blanket insurance coverage for meetings, and blanket bonding of treasurers.

3) *Enhancement of the professional status of members by:*

a) Developing coordinated standards for the Profession of Quality Control Engineers.
b) Initiating steps to urge the various states to conduct examinations and issue licenses to Quality Control Engineers; to encourage universities to offer specific degree work and recognition in the field of Quality Control Engineering.
c) Gradually becoming more restrictive in membership requirements, particularly in the Senior and Fellow grades.

4) *Continue to encourage, and assist in, the holding of quality control conferences, seminars, training courses, and other media for the interchange of ideas and knowledge.*

a) Division Officers and Technical Committee Chairmen are increasing their planning meetings from one to four a year, with the formation of a General Technical Council.
b) District Representatives are being asked to greatly increase their participation in affairs of Sections within their jurisdiction, to provide better liaison with and service to Sections.

5) *Increase the stability and effectiveness of INDUSTRIAL QUALITY CONTROL and other Society publications.*

Increase the income from publications by 20 percent this year, through such means as increased advertising and library subscriptions. The eventual goal is to increase editorial space in the magazine by 20 percent in 1958-59.

6) *Operate on a balanced budget.*

We have set the above specific goals, and corresponding implementing programs, to further the effectiveness of the Society in six key areas. The success of these programs is dependent on the effort of the Officers and Committee Chairmen and Committee Members, but also, to a large degree, on the cooperation extended by you, the Society Members. By the same token, the successful execution of these programs will be of direct and continuing benefit to you.

Sincerely,

Leon Bass

An Application of Statistical Control Techniques to a Post Office Processing Operation*

JAMES P. OXENHAM

Post Office Department, Washington 25, D. C.

Introduction

In the spring of 1953 the Post Office Department initiated a study of the various methods in use in private industry to effect improvement in operational methods. This study embraced consideration of control charts and related techniques as employed in "Quality Control" activities. Applications of statistical inference and control chart methods were made to an individual postal processing operation at each of four selected post offices. The applied control chart technique and the data obtained at one office pursuant to these studies are the subject of this article. The efforts made at the four post offices cannot be construed as "pilot installations" but rather as demonstrations of an economical, timely, and highly effective statistical device as applied to operation appraisal.

Postal Operations

People in general are cognizant of street letter boxes and the carriers' delivery but are uninformed as to the processes through which letters pass between the act of collection and the act of delivery.

The principal function of the postal service is the *collection, transportation,* and *delivery of mail matter.* To execute this function the service employs more than 500,000 people whose activities are classified as administration, finance, supplies and facilities, transportation of mails, and postal operations. Of the total annual expenditures of 2 billion dollars, 72 percent is expended in postal operations—those activities of sorting and carrier delivery. Such activities are subgrouped as pertaining to outgoing mails which include those tasks in a post office associated with mail originating in that office, and those tasks required in connection with incoming mail, such as, preparing the mail for delivery at that particular office.

This study was limited to letters but is essentially applicable to all physical types of mail matter. Further, the study concerned the post office of origin, and the "outgoing mail" only, as distinguished from the "incoming mail" destined for delivery at a particular post office.

The principal outgoing postal operations may be considered as facing and cancelling, primary, secondary, and tertiary sorting or distributing activities. The control chart technique was tried on the facing and cancelling operation only, due to the ease of measurement and the fact that such operation had been subject to much investigation.

Facing and Cancelling Operation

Following collection from street letter boxes, the letters arrive in sack quantities at a central station, or main office. The sacks are emptied on long rectangular tables and the letters are thus in a "pied" condition, and mixed with small packages, newspapers and cards. (see Fig. 1.)

The facing and cancelling operation involves the arrangement of the letters in such fashion as to facilitate the simultaneous application of a postmark and the defacing of the postage stamps to prevent reuse. More important—an orderly arrangement is required for the distributing, or sorting operations which follow the postmarking.

*This article was one of two papers presented at the March 23, 1955 meeting of the Washington Section of ASQC, following a local talent contest restricted to initial efforts of "unpublished" newcomers.

Left, Figure 1—Rectangular facing table, manned by eight facers. Note pied condition of mail and the position of letters about to be slotted.

Figure 2—The same facing table layout. Note belts overhead and pigeon holes for non-slottable matter. This study revealed no significant effect on rate of production by use of belts as compared to use of pigeon holes. The ratio of eight facers and one cancelling machine operator is at optimum ratio.

The desired arrangement is effected by picking up a letter, turning the letter until the address side is toward the reader with the stamp in the lower left corner, and depositing the letter in one of two slots—one for short length envelopes, and the second for long envelopes—along the front edge of the table. Letters with multiple stamps, special delivery or airmail endorsements, or bulky contents are placed in a series of pigeon holes supended above the table. (See Fig. 2.)

The slotted letters are maintained on edge in the slots and are carried by the action of an endless belt, which forms the bottom of the slots, to stacking devices. At this point the letters are removed in handful amounts—still on edge—and inserted in a postmarking, or cancelling machine which applies an inked indicia across the stamp at a potential rate of 24,000 to 25,000 letters an hour. The machine is adjusted to accommodate short, then long envelopes as indicated by the volume accumulating in the stackers. (See Fig. 3.)

This operation varies between one post office and another depending upon the space and the conveyor belt installations. In lieu of pigeon holes over the table some offices have layers of belts above the facing table and non-slottable matter is placed there, or in canvas tubs arranged at the rear of the table.

Attribute, Measurement, and Subgrouping

Production in the operation was defined as the number of letters faced and cancelled per expended manhour. The count of such letters was available each half hour from a meter already built into the cancelling machine. The expended manhours were obtained by count of the number of men, including machine operator, each 10 minutes of the half hour, converted to manpower hours, and related to machine count.

Based upon experience as to the characteristics of collection mail, two-hour periods were selected as representative of before noon, late afternoon, and evening collections. These subgroups of two hours each were formed as reflecting the possible differences between periods and at the same time reflecting uniformity within such periods.

Figure 3—Cancelling process associated with the same facing unit. Note manual feeding of postmarking machine by handful amounts as grasped from table stacking device at right of machine operator. Note also the position and postmark of completely processed letters.

Production was "sampled" each half hour by formulation of the expended manhours and the letters faced and cancelled. Separate control charts were prepared for each of the selected two-hour periods and a composite control chart for the three two-hour subgroups.

Computation of Averages and Limits

Actual observations were begun May 11, but the control limits for both averages and ranges were computed based on the data of May 18 through June 1—a total of 11 working days excluding Saturday and Sunday. For reasons to be mentioned later the initial period of May 11 to 17 was omitted in computation of limits. Grand average, average range, and control limits for the two-hour periods were computed as follows:

Average	*Range*
$\bar{X} = \frac{\Sigma X}{n} = 1509$	$\bar{R} = \frac{\Sigma R}{n} = 391$

Limits

Means	*Ranges*
$\bar{X} \pm A_2 \times 391$	$391 \times D_3$, and $\times D_4$
UCL = 1794	UCL = 892
LCL = 1221	LCL = 0

The above computations involved the use of factors derived for establishment of limits based upon sample size of four; the absence of given standards or specified limits; and the acceptance of $\bar{X}$'s and R's as computed from data of the period May 18 to June 1.*

Charting

Control charts were prepared and data of June 1 to August 28 were plotted. (See Fig. 4.) As points fell beyond control limits, attempts were made to determine assignable causes. Since no direct action was to be taken, the positive demonstration as to the probable cause could not be made. However, as recurring combinations of manpower, volume, and other factors, associated with a time interval, appeared over the entire duration of the study and with similar results, reliable inferences could be made.

Control Comments

The data of the period May 11 through 15 were excluded from the computation of control limits as the operating conditions of that period were recognized as non-standard. During one week of each quarter selected post offices conduct counts as required by the Cost Ascertainment System of the Post Office Department. One purpose of these counts is the determination of the per-piece revenue of originating mail by classes and subclasses. The facing and canceling operation at this particular office is altered to provide additional separations on the overhead bridge for specific items, such as post cards, postal cards, official and franked mail bearing no postage, circulars, and letters with postage in excess of three cents. Only those letters bearing three cents postage were slotted and cancelled.

The charting was begun May 11 to permit indoctrination in the collection and plotting of data and to permit a measure of the effect on the production rate of such Cost Ascertainment activities. The continuation of the control charts through a second count period, August

*ASA Manual Z 1.3-1942. Appendix 1.

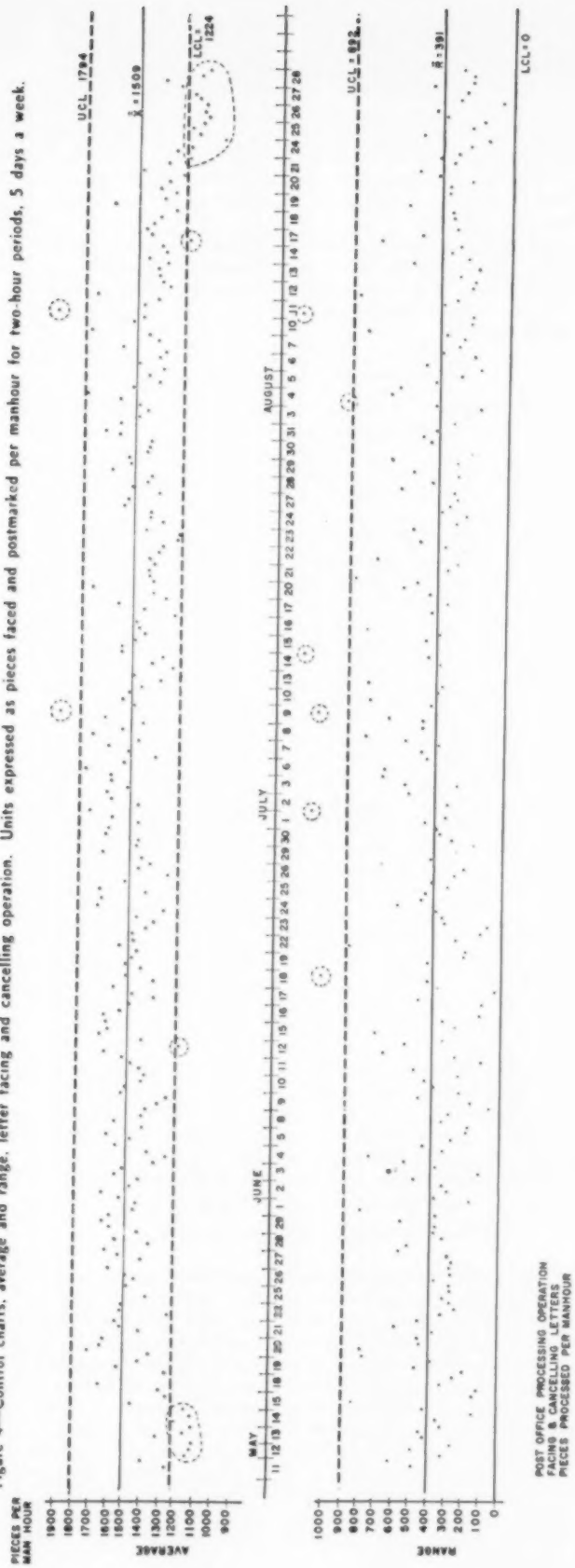

Figure 4—Control charts, average and range, letter facing and cancelling operation. Units expressed as pieces faced and postmarked per manhour for two-hour periods, 5 days a week.

24 through 28, provided a second estimate of this same effect.

The control limits computed from the data of May 18 through June 1 were accepted as indicating good control. This did not imply that management was satisfied with the average performance; in fact, the range of the average production per manhour was operational information heretofore unrevealed to the supervisors. Since no specific limits had ever been established, and the mode of operation was a generally accepted one, the continued graphic presentation using the limits based upon the preliminary data was deemed more advisable than imposing arbitrary limits. The decision was made "to let the operation speak for itself" and to attempt discovery of causes responsible for the extreme variations of the average production.

Although the operating conditions were considered standard it was known that changes fundamental to the operation would eventually have to be made; perhaps as a result of this control charting of each of the two-hour periods. As this application of statistical control techniques was by instruction limited to passive analysis, the study is not purported to be an example of what was accomplished by control charting but does provide an excellent example of the timely and effective identification of periods of costly processing. The charted data of individual two-hour periods is not presented here in the interest of brevity and due to the extent to which the avowed purpose of demonstration was accomplished by consideration of the one set of average and range charts. (See Fig. 4.) The charts of the individual two-hour periods only substantiate in greater detail the conclusions and inferences based upon the composite charts.

Assignable Causes

1. *Assignment of personnel to facing tables was not coordinated with the volume of mail.* The two-hour period 5 to 7 pm of Friday, June 12, was out of control (See Fig. 4 chart for averages) due to the 5:30 to 6 production rate of only 923 pieces per manhour. Total collection volume for the half-hour fell approximately 27 percent from the normal level but assignment of men and the scale of the operation were maintained in a routine fashion. The practice of increasing the number of men in accordance with collection schedules rather than the amount of mail placed personnel assignment *on a time basis rather than a need basis.* The assignment of men was generally routine in all periods of the day. Management justified such practice by reference to the requirements of timely postmarking. A rule of the service dictates prompt facing and cancelling. Such justification was rejected in view of the results of this period and the June 18 and July 1 periods.

2. *Lack of communication between collection mail unit and facing unit supervisors.* The 5 to 7 pm period of Thursday, June 18, revealed lack of control. (See Fig. 4 chart for ranges) Again, collection volume fell but the two-hour average production was above the grand average. The average of the 5:30 to 6 period was 1014—better than that of the June 12 period—and that of the period of 6 to 6:30 was 2061. This high rate of production was attained several times during the 18 weeks of study but only for half-hour periods. The improvement in the 5:30 to 6 period was the result of anticipatory action, in contrast to the situation of June 12, and that of the 6 to 6:30 period developed from an increased volume without change in assigned personnel.

3. *Improper expansion and contraction of the operation.* The expansion of the facing and cancelling operation

from one table up to five tables and the contraction from five to a fewer tables, as necessitated by volume changes and postmark requirements, were unit management decisions. These decisions proved to be a major factor in the rate of production per manhour, particularly during initial and terminal half-hour periods.

The half-hour average production rates of the two-hour period 7 to 9 pm of July 1 had a range of 1093, due to a heavy increase in the volume, which carried through the terminal half-hour, 8:30 to 9. In this instance the usual contraction rate of the number of facing tables combined with a late heavy volume to produce a most economical production average. The two-hour average of 1735 pieces per manhour resulted principally from the last half-hour average of 2463.

The lack of control in the 7 to 9 pm period of July 14 and the 10 to Noon period of August 4 (See Fig. 4 chart for ranges) was due to terminal half-hour production rates of 2259 and 2070, respectively. The two-hour average production rates of 1566 and 1582 were above the grand average. Also, on August 4 the favorable two-hour average of 1793 of the 5 to 7 pm period was due to an initial half-hour average of 2000. For this same assigned cause—the initial and terminal scale of operation—the average and range of production of the 10 to Noon period of the following Tuesday, August 11, were out of control. On August 11, however, both the initial and terminal half-hour periods were high in production with rates of 2761 and 2100. It was significant that total two-hour volumes of August 4 and 11 were the same, approximately 35,000 pieces.

The period of 10 to Noon of August 17 was out of control due to the significantly low production in each of the two half-hour periods 10 to 10:30 and 11 to 11:30. This was occasioned by delayed collection arrivals due to extreme summer temperature and the improper expansion and continuance of the operation on too many facing tables. Planning of the work occurred *after the mail was dumped on the tables*—too late to effect a reduction in the number of tables.

4. *Departures from prescribed mailhandling procedures.* The lack of control evident in both average and range charts for the two-hour period 5 to 7 pm of July 9 was due to an otherwise undetected departure from prescribed handling procedure. One element of the facing and cancelling operation required continuous close scrutiny by the unit supervisors. This element involved the handling of "bundle mail"—those letters thoughtfully faced and tied as bundles by the mailers themselves. This practice has proved of tremendous benefit, particularly at Christmas time, and the Post Office Department has encouraged its use throughout the year by publicity and enlistment of the cooperation of the large mailers. It is an established procedure that such bundles are not to be untied and individually slotted for machine cancellation. The bundles are removed from the collection mail after dumping on the facing tables, and are processed by a separate unit.

The lack of control evidenced by both average and range charts for the two-hour period could be attributed to no other factor than improper, or non-standard handling of such bundle mail. Inquiry as to possible non-operating procedures revealed the absence of many regularly assigned employees due to annual leave, and the increased dependence on substitute or part-time employees who were less familiar with the facing operation.

5. *Change in collection schedules.* The period of July 10 to 27 was one of decreasing volume, attributable to the seasonal mailing pattern and to the effect of reinstitution of a late street letter box collection. In 1950 the postal service curtailed late collections; in 1953 such collections were resumed in a limited number of principal cities. It was believed that mail would be expedited inasmuch as late deposits would no longer lay uncollected until morning. As supported by this, and by subsequent data, an effect on late afternoon volume was unanticipated. The public apparently delayed depositing their mailings because a later collection had again become available.

As first revealed by this study, local management was not immediately aware of this secondary effect and in the absence of a precise measurement the effect on any given operation went unnoticed. (See Criteria of Local Stability.)

Supervision—The Key to Production

The conclusion definitely established by the study was that initial and ending half-hours of the two-hour periods were susceptible of significantly high or low average production. In such periods the judgment of the unit supervisor in assigning or withdrawing manpower was the dominating factor.

The fluctuating volume of mail, not within the control of postal management other than scheduling of collections, and the service requirements in respect to prompt postmarking as to date and hour, required of the operating supervisors the exercise of judgment in matching with the amounts of work the proper number of facing and cancelling tables and clerical manpower.

The maximum utilization of manpower required frequent and prompt changes in the number of men assigned to particular processes which compose a chain of operations from facing, cancelling, primary, secondary, and tertiary sorting.

Although not pinpointed by any significant lack of control, other than July 9, the absence of well-defined mailhandling procedures and the need for uniform training of supervisors and clerks operating in a situation involving frequent changes in the scale of the operation and in the make-up of the groups appeared responsible for the variation and shifts in the overall average production. The claim of unit supervisors that racial characteristics were the cause of varying rates of production was not sustained by the data of this study. Overstaffing of the facing tables was not a general condition but was quite evident during certain half-hour periods. It is significant, however, that an upward trend in the average production rate occurred during the period June 29 to July 9, a period in which increased usage of annual leave resulted in a reduction of available personnel and a more nearly optimum ratio between the number of employees facing mail and the number operating cancelling machines.

Additional Uses of the Data

Up to this point the mechanics and function of control charts may be considered fairly evident. Experience during the study substantiated the claim that operational personnel can readily use and interpret such charts. However, the detection of some assignable causes and the possibility of prompt action based upon such detection constitute but one use of the information afforded by statistical appraisal.

Cost standards and standards of performance have been advocated for the major mail distributing operations. Such standards would involve the establishment, acceptance, and use of some production average, upon the reliability of which would depend the validity of the standards.

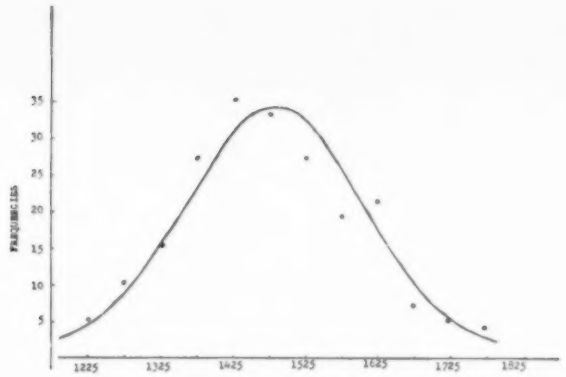

Figure 5—Normal curve fitted to data of May 18—August 24. By Chi-square test the fit is significant.

The existence of a stable system of causes is assumed in the acceptance of a series of production samples and the formulation of control criteria. In the subject study there appeared, initially, no basis on which to reject this assumption. The "goodness of fit" test (See Fig. 5) applied to the entire 18 weeks data did not invalidate the original assumption. But a visual examination of the plotted averages revealed sequences of points tending upward or downward, at times close to the computed control limits. Such a sequence involving seven or more points was in itself a reliable indication that over all stability did not exist; or at best, stability existed only periodically. The fact was recognized that the assumed independence of the two-hour production averages and the grouping of the data according to magnitude only and in disregard to time order resulted in absorbing some of the assignable causes of variation.

The recognition of this fact did not vitiate the results of the study, but it did reveal the limitations of the applied test of stability and afforded demonstration of the additional benefit to be derived from the study. The arrangement of samples in time sequence (control chart method) provided information regarding the possible correlation between successive samples—information of considerable value to understanding the characteristics of the production process and to appraisal of process standardization.

The duration of the study (18 weeks) provided a basis for analyzing the established average and a means for identifying the costs in certain short (local) periods or protracted (grand) periods of overproduction or underproduction as due to chance variation and hence acceptable, or as due to causes extraneous to the operation.

Stability of the Average Performance Rate

Following an analytical method suggested by Adam Abruzzi,* a measure of periodic stability was applied to this data. To the average two-hour performance rates of weekly periods (5 days) was applied a ratio test developed by John von Neumann and his associates and modified by A. H. J. Baines.‡ The test of the ratio of the mean square successive difference to the variance may be used to identify trends or the absence of trends and hence to identify periods of stability.

*Adam Abruzzi, *Work Measurement—New Principles and Procedures*, Columbia University Press, 1952.

‡A. H. J. Baines, Technical Report—Series R, Ministry of Supply, Advisory Service on Statistical Method and Quality Control, S. R. 17, February 5, 1954, London. See also von Neumann, Kent, Bellinson, and Hart, "The Mean Square Successive Difference", *The Annals of Mathematical Statistics*, Vol. XII (1941), p. 153-162.

The ratios computed were:

$$\frac{\delta^2}{S^2} = \frac{\sum_{i=1}^{n-1} (X_{i+1} - X_i)^2}{\sum_{i=1}^{n} (X_i - \overline{X})^2}$$

Where:

n = number of observations per week;
i = the temporal order of the observations in the 5-day period;
X_i = the i-th observation; and,
X = the weekly mean of the observations.

A small ratio value indicates that the successive observations are positively serially correlated as when a trend or a series of ascending or descending values occur; a high ratio value indicates that the successive observations are negatively correlated—an alternating series of high and low values occur in definite relationship to the time period. A ratio value approximating two indicates a random arrangement of production averages.

Criteria of Local Stability

The following tabulations were derived by application of the ratio test to data of weekly periods and indicated most of the 5-day, or weekly, data were stable based upon the narrow departure of 0.50 from 2.0 in the computed values. The significance level applied here approximates 0.90.

Ratio Test Results (Local Stability)

Period	Ratio	Comment
May 11-15	1.90	Stable
18-22	2.00	Stable
25-29	2.56	Stable
June 1-5	1.49	Descending
8-12	2.00	Period
15-19	1.26	Descending
22-26	1.94	Stable
June 29 - July 3	2.46	Stable
July 6-10	1.96	Stable
13-17	2.09	Stable
20-24	1.86	Stable
27-31	1.49	Ascending
Aug. 3-7	1.55	Descending
10-14	1.81	Stable
17-21	2.07	Stable
24-28	1.36	Descending

Conclusions Derived from Study of Local Stability

The conclusions possible at this point concerned the nature of the average production per manhour attained in the 5-day periods exhibiting trends. The average production of these periods is questionable for the purpose of standardization until the causal factors are identified.

The ratio test results directed attention to specific 5-day periods, namely:

May 11 to 15 and August 24 to 28. As previously mentioned the facing and cancelling operation is altered during a selected week of each quarter to facilitate the counting of pieces of mail and postage revenue by subclasses of mails pursuant to the Cost Ascertainment System of the Post Office Department. The direct additional cost of this count is identified by an employee time record and by the charges (in minutes) as entered therein by the employee. However, the induced effect of such Cost Ascertainment count periods on the average cost of production in the facing and cancelling operation was measured for the first time.

The two-hour production rates attained in the May 11 to 15 period appeared stable about an average of 1218, a

significant departure of 291 pieces per hour from the grand average. The evidence of local stability and out-of-control condition revealed by the chart for averages substantiate this departure as due to Cost Ascertainment requirements. Thus, we have an estimate of the effect upon production due to such requirements.

The data of the second Cost Ascertainment period, August 24 to 28 did not exhibit stability (see Ratio Test Results—Local Stability), but exhibited a significant trend downward with 12 of the 15 two-hour ranges falling below the average range. Thus, the average two-hour production rate of 1177 for the week was a significant departure of 332 pieces per hour from the grand average but could not be attributed solely to the Cost Ascertainment activities. An additional cause appeared to be in effect. (See Conclusions Derived from Study of Grand Stability.) Although not all of the decrease in the average production rate could be charged to Cost Ascertainment, the absolute quantity of this decrease did substantiate the 291 decrease estimated from the effects noted in the May 11 to 15 week.

June 1 to 5. Ten of the 15 two-hour ranges fell below the average range and as revealed by the ratio test constituted evidence of a significant downward trend in the production rate, for which no assignable cause was determined. This condition precluded acceptance of the conduct of the operation as standard during that period.

June 15 to 19. Again, ten of the 15 two-hour ranges fell below the average range. However, the assignable causes were decreasing volume and the identified action taken by the unit supervisor as a result of the June 12 experience. (See Assignable Causes, 2, p. 7.) The operation was concluded to be non-standard during this 5-day period.

July 27 to 31. The ranges of the individual two-hour production rates were evenly distributed above and below the average range. Nine of the 15 two-hour average rates of production were above average with a trend upward.

A review of the personnel assigned and of the total volumes processed during this period revealed a high rate of annual leave and a decreasing workload. No single, assignable cause was established for the significant upward trend. A period of non-standard operation was indicated.

August 3 to 7. Nine of the 15 ranges were below average, one was out of control on August 4. The extremely unpleasant conditions resulting from the summer temperatures were particularly noticeable on August 7. As revealed by further trend analysis for an extended period of time (see Conclusions Derived from Study of Grand Stability) an unseasonable decrease in volume was having an adverse effect on the entire scheduling and programming of this operation. The effect of collection schedule changes was not fully discernible to management at this time.

Criteria of Grand Stability

The ratio test was applied to three periods of increased duration with the following results:

Ratio Test Results (Grand Stability)

Period		Ratio	Comment
June 22-July 10	(3 weeks)	1.81	Stable
July 13-August 7	(4 weeks)	1.56	Stable
August 10-21	(2 weeks)	1.94	Stable

The average production per manhour for the stated three periods was 1542, 1451 and 1453 respectively. While stability was exhibited in each of these periods the overall average of the combined periods was below that of the combined preceding periods.

Conclusions Derived from Study of Grand Stability

The ratio tests of grand stability supported a conclusion of stability for the period July 13 through August 21, at a rate below the computed $\bar{X}$ of 1509. Inspection of the plotted averages invited attention to the approximate level of production maintained from July 13 on. From recorded observations made daily, one incident assumed significance. The re-institution of late evening collections about the middle of July, after many months of only early evening collections, was previously considered as having advanced the processing of letter mail which were normally deposited after the early evening collections. (See Assignable Causes 5, p. 8.) As indicated by volume and cancellation records, many patrons availed themselves of the new late-night collection by deferring early evening deposits, thus shifting the volume to a later hour in respect to the facing and cancelling operation. This change in collection schedules was not reflected in changed scheduling of the facing and cancelling operation.

The continued lowered production rate of the Period July 13 through August 21 was associated with the collection schedule changes initiated during the midsummer and indicated improper rescheduling and reprogramming of personnel. The period of August 24 to 28, adversely affected by Cost Ascertainment activities (see Conclusions Derived from Study of Local Stability), was further depressed by collection schedule changes. As indicated above, the production of this second Cost Ascertainment period was significantly below the operation average and below the average of the first period, May 11 to 15.

Evaluation of Control Charting Method

This application of control chart procedures was exploratory, and the results were neither startling nor revolutionary. The inferences developed were generally acknowledged but the other methods leading to these inferences did not provide as graphic, timely, economical, or as conclusive a body of evidence in their support.

By charting and by invoking the principles of probability we have, at a fraction of the expense of existing procedures, established a barometer of productivity.

The objective determination of the cost of Cost Ascertainment count and revenue studies, appraisal of changes in factor combination, and the evaluation of improved mechanical methods are just some of the important by-products of this method.

The dedication of the Postal Service to improved service at less cost requires decisions based upon cost determination. While costs are important, the Postal Service must be ever mindful of the element of public service. The statistical device applied here may prove an effective tool in the achievement of a reasonable, economical balance as between these two considerations.

Acknowledgment

Acknowledgment is made of the contribution of Dr. W. E. Deming in this adaptation of the statistical method to postal operating processes.

An Evaluation of the Maytag Double-Line Chart*

R. L. MADISON AND B. OSTLE

Introduction

Howell[1] applied the theory of extreme values to statistical quality control when he investigated the control chart for the largest and smallest values (L-S Chart) in a random sample of size n assuming the sampled population to be of normal form. The operating characteristic function of this chart was compared with that for the combined control charts for the sample mean, $\bar{X}$, and the sample range, R. In this article a modified control chart for largest and smallest values known as the *Maytag Double-Line Chart*† (MDLC) is investigated and compared with the L-S chart of Howell as well as with the combined $\bar{X}$, R charts.

Rationale Underlying the Development of the MDLC

The quality control personnel at Maytag felt that the concept of a control chart could be more easily explained to operators if individual samples values were plotted rather than just the sample mean. After considerable experimentation, the MDLC was adopted. This chart, *which indicates control or lack of control with respect to a specified standard*, was developed in accordance with the principles outlined below.

The process will be termed "in control" with respect to the specified standard provided the entire sample falls within the engineering specification limits‡ and does not violate two further restrictions:

- That the sample range shall not exceed six standard deviation units for the range.
- That the sample range shall not exceed six standard to one or the other engineering specification limit.

The first restriction is essentially the same as that imposed by the R chart.

The reasoning behind the second restriction is that if an entire set of sample values falls too close to the upper engineering specification limit, then this is a good indication that the lot mean has shifted upward. If this is true and if the lot has a greater than average range, there may be some pieces from the lot larger than the maximum engineering specification would allow. Similarly if the samples lie too near the lower engineering specification limit some of the pieces may be too small.

These critical regions are thought to be some function of the range. Thus a second pair of control limits is drawn on the chart, one a distance $k\,D_2\,\sigma''$ below the upper engineering specification limit and the other a distance $k\,D_2\,\sigma''$ above the lower engineering specification limit.* When all the sample points fall between the upper engineering specification limit and a point $k\,D_2\,\sigma''$ below the upper engineering specification limit and correspondingly, when all sample points fall between the lower engineering specification limit and a point $k\,D_2\,\sigma''$ above the lower engineering specification limit, the chart indicates a lack of control with respect to the specified standard.

To determine a workable value of k, the Maytag control chart was compared with the combined control charts for the mean and range then in use. Over a period of time k was adjusted until the MDLC termed the process out of control on the same occasions the combined control charts for the mean and range indicated lack of statistical control. The final value of k was thus determined to be 0.80.

Operation of the MDLC

The MDLC has four control limits which will be designated by:

USL = Upper engineering specification limit
LSL = Lower engineering specification limit
UC = Upper control limit
LC = Lower control limit

where

$$\begin{aligned} UC &= USL - 0.80\,D_2\,\sigma'' \\ &= \bar{X}'' + 4\,\sigma'' - 0.80\,D_2\,\sigma'' \\ &= \bar{X}'' + (4 - 0.80\,D_2)\,\sigma'' \qquad (1) \end{aligned}$$

$$\begin{aligned} LC &= LSL + 0.80\,D_2\,\sigma'' \\ &= \bar{X}'' - 4\,\sigma'' + 0.80\,D_2\,\sigma'' \\ &= \bar{X}'' - (4 - 0.80\,D_2)\,\sigma'' \qquad (2) \end{aligned}$$

If the smallest sample observation be designated by X_1 and the largest by X_n, the samples that lead to classifying the process as out of control are:

(i) $X_1 > UC$
(ii) $X_n < LC$
(iii) (one or more sample observations) $> USL$
(iv) (one or more sample observations) $< LSL$
(v) $R = X_n - X_1 > (D_2 - D_1)\,\sigma''$

These are not mutually exclusive cases; for example, a particular sample might satisfy (i), (iii), and (v) simultaneously.

In Fig. 1, all samples of size five that correspond to the chart indicating that the process is in control with respect to the specified standard are shown. For each sample it is assumed that $R < (D_2 - D_1)\,\sigma''$ which, for $n = 5$, reduces to $R < D_2\,\sigma''$.

Operating Characteristic of the MDLC

To find the operating characteristic of the MDLC, we will assume the population to be normally distributed.

*Based upon a thesis submitted by the senior author in partial fulfillment of the requirement for the degree of Master of Science at Iowa State College, 1952. Mr. Madison is with Aeronautical Radio Inc.; Dr. Ostle is with Montana State College, Bozeman, Mont.

†This chart was developed by G. A. Helberg, Chief Manufacturing Engineer, for use by the Maytag Co., Newton, Iowa.

‡Mr. Helberg advised the authors that, whenever possible, the Maytag Co. uses plus and minus four standard deviations (based on an analysis of past data) in selling engineering specification limits.

*D_1 and D_2 are the constants used in setting limits on the standard R chart.

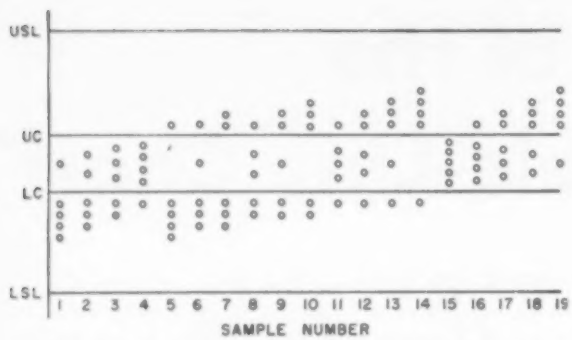

Figure 1—Samples of Size Five Which Correspond to the Production Process Being *In Control* When the Maytag Double-Line Chart is Used ($R < D_2\sigma''$)

The probability of accepting may be evaluated by integrating the joint distribution of X_1 and X_n, say $g(X_1,X_n)$, over the acceptance region in the X_1–X_n plane. This joint distribution of X_1 and X_n is specified by*

$$g(X_1,X_n) = n(n-1)\, f(X_1)\Big[F(X_n) - F(X_1)\Big]^{n-2} f(X_n). \quad (3)$$

For ease in integrating, the acceptance region is subdivided into three parts and, setting $D = D_2 - D_1$ for simplicity, the probability of acceptance P_a is then,

$$P_a = P_1 + P_2 + P_3$$

$$= \int_{LSL}^{USL - D\sigma''} \int_{LC}^{X_1 + D\sigma''} g(X_1,X_n)\,dX_n dX_1$$

$$+ \int_{USL - D\sigma''}^{UC} \int_{UC}^{USL} g(X_1,X_n)\,dX_n dX_1$$

$$+ \int_{LC}^{UC} \int_{USL - D\sigma''}^{X_n} g(X_1,X_n)\,dX_1 dX_n \quad (4)$$

It may be shown that

$$P_2 = \Big[F(USL) - F(USL - D\sigma'')\Big]^n - \Big[F(USL) - F(UC)\Big]^n - \Big[F(UC) - F(USL - D\sigma'')\Big]^n \quad (5)$$

$$P_3 = \Big[F(UC) - F(USL - D\sigma'')\Big]^n - \Big[F(LC) - F(USL - D\sigma'')\Big]^n \quad (6)$$

*In this paper $f(X) = \frac{1}{\sigma'\sqrt{2\pi}}\, e^{-(X-\bar{X}')^2/2\sigma'^2}$

and $F(X) = \int_{-\infty}^{X} f(X)\,dX.$

and hence

$$P_2 + P_3 = \Big[F(USL) - F(USL - D\sigma'')\Big]^n - \Big[F(USL) - F(UC)\Big]^n - \Big[F(LC) - F(USL - D\sigma'')\Big]^n \quad (7)$$

The evaluation of P_1, however, is not so straightforward, since

$$P_1 = \int_{LSL}^{USL - D\sigma''} \int_{LC}^{X_1 + D\sigma''} g(X_1,X_n)\,dX_n dX_1$$

$$= n \int_{LSL}^{USL - D\sigma''} \Big[F(X_1 + D\sigma'') - F(X_1)\Big]^{n-1} f(X_1)\,dX_1 + \Big[F(LC) - F(USL - D\sigma'')\Big]^n - \Big[F(LC) - F(LSL)\Big]^n \quad (8)$$

and the integral in the first term of this expression cannot be evaluated exactly by simple methods. Thus recourse was made to approximation procedures which provide upper and lower bounds to the true value.

Theoretical Comparison of the MDLC with Howell's L-S Chart and With the Combined $\bar{X}$ and R Charts

For evaluation of the MDLC, we shall extend the method used by Howell[1] for comparing control charts for the mean and the range with the control chart for the largest and smallest individuals to include a comparison with the MDLC. Howell assumed as a standard a normally distributed population with mean zero and standard deviation of one. He then computed the probability of concluding that a process is producing parts whose measured dimensions conform to the standard population, when in fact its true mean was $\bar{X}'$ and its standard deviation σ', for both the $\bar{X}$, R control charts and for the L-S chart. Thus, in effect, he compared the discriminatory powers of the two charts at various combinations of $\bar{X}'$ and σ' for samples of sizes two, three and five.

Howell's L-S chart requires that the extreme sample values lie between an upper and lower control limit if the process is to be considered in control. The probability of concluding the process is in control when producing lots that are normally distributed with mean $\bar{X}'$ and standard deviation σ' is simply,

$$P_{L\text{-}S} = n(n-1)\int_{LCL}^{UCL} \int_{LCL}^{X_n} f(X_n)\Big[F(X_n) - F(X_1)\Big]^{n-2} f(X_1)\,dX_1 dX_n$$

$$= \Big[F(UCL) - F(LCL)\Big]^n \quad (9)$$

where UCL is the upper control limit and LCL is the lower control limit.

For purposes of comparing the L-S chart with $\bar{X}$, R control charts, Howell selected UCL and LCL in such a manner as to make the probability of type I error for the two schemes equal.

With the $\bar{X}$, R charts, the probability of concluding that a process producing items of product which are

TABLE I—Probabilities for the MDLC, $\bar{X}$, R Charts, and L-S Chart, of concluding that a process with mean $\bar{X}'$ and standard deviation σ' is in control when limits are set on the basis of the standards $\bar{X}'' = 0$ and $\sigma'' = 1$

$\bar{X}'$	σ'	PROBABILITIES				
		Maytag Double-Line Chart			Mean-Range	Largest, Smallest
		First approximation	Second approximation	Third approximation		
0	1.0	0.5882—0.9524	0.8980—0.9513	0.9333—0.9508	0.992	0.992
	1.2	0.4646—0.9451	0.8326—0.9378	0.8725—0.9342	0.957	0.957
	1.5	0.3325—0.9124	0.6512—0.8754	0.7135—0.8589	0.817	0.878
	2.0	0.1909—0.7489	0.3699—0.6505	0.4230—0.6125	0.509	0.545
0.5	1.0	0.5900—0.8645	0.8260—0.8638	0.8463—0.8631	0.965	0.980
	1.2	0.4820—0.8802	0.7680—0.8741	0.8120—0.8709	0.913	0.927
	1.5	0.3476—0.8591	0.6131—0.8271	0.6727—0.8111	0.763	0.791
	2.0	0.1935—0.6964	0.3526—0.6190	0.4027—0.5828	0.473	0.505
1.0	1.0	0.4905—0.6145	0.5800—0.6141	0.5991—0.6134	0.722	0.923
	1.2	0.4620—0.6886	0.5945—0.6852	0.6320—0.6819	0.713	0.828
	1.5	0.3567—0.7072	0.5050—0.6855	0.5574—0.6724	0.594	0.661
	2.0	0.1973—0.5959	0.3056—0.5286	0.3197—0.4464	0.381	0.426
2.0	1.0	0.1067—0.1149	0.1086—0.1149	0.1108—0.1147	0.071	0.512
	1.2	0.1699—0.2008	0.1763—0.2008	0.1835—0.1997	0.107	0.402
	1.5	0.1879—0.2710	0.2041—0.2670	0.2185—0.2622	0.140	0.286
	2.0	0.1310—0.2783	0.1566—0.2571	0.1739—0.2438	0.135	0.185

normally distributed with mean $\bar{X}'$ and standard deviation σ' is in control is the product of the probability that a sample mean is in control and the probability that the corresponding sample range is in control.

The control limits for the MDLC are dependent upon the particular engineering specification limits chosen. In designing the MDLC, the intention was to set the control limits in such a manner that the lots rejected by the MDLC would be the same as those rejected by the $\bar{X}$, R control charts. The USL and the LSL were set at $\bar{X}'' + 4\sigma''$ and $\bar{X}'' - 4\sigma''$, respectively, and a value for k, where $UC = USL - k D_2 \sigma''$ and $LC = LSL + k D_2 \sigma''$, was determined empirically such that the two charts would, as nearly as possible, lead to "out of control" statements in the same cases. The value for k was determined* to be 0.80.

Since the basis on which the two charts are made comparable is only one of several possibilities, it is important to compare the relative performance of the two charts by examining their operating characteristics. As a matter of interest the comparison is also made with Howell's L-S chart. The OC function for the MDLC was evaluated for certain selected values of $\bar{X}'$ and σ' (namely the same ones used by Howell in his comparison of the L-S chart with the $\bar{X}$, R control chart).

Table I presents the probabilities for the MDLC, the $\bar{X}$, R charts, and the L-S chart of concluding that a process with mean $\bar{X}'$ and standard deviation σ' is in control when limits are set on the basis of the standards $\bar{X}'' = 0$ and $\sigma'' = 1$. Only samples of size five have been considered. For the MDLC, the first, second, and third approximations to the upper and lower bounds for the true probability are given.

The MDLC does not always agree too closely with the $\bar{X}$, R charts for the values of $\bar{X}'$ and σ' considered. For $\bar{X}' = 0, 0.5, 1.0$ and $\sigma' = 1.5, 2.0$, the probabilities agree fairly well but in all other cases studied the agreement is not too good. This suggests that the MDLC is somewhat insensitive to small changes in σ' and large changes in $\bar{X}'$. We have not calculated the probability of concluding the process is in control for the case where the mean of the lot is greater than two standard deviation units to the right or left of the expected value nor when the standard deviation for the lot is more than twice the expected standard deviation. However, this hardly seems necessary in view of the performance of the MDLC for those values of $\bar{X}$ and σ' considered.

*Had k been set at 0.72, the probability of type I error for the MDLC would more nearly equal the probability of type I error for the $\bar{X}$, R control charts.

Conclusion

It is well known, of course, that the first stage of control chart operation consists of analysis of past data. This analysis answers two questions:

(i) Has the process been in control?

(ii) If the process has been in control, was the product satisfactory?

However, in spite of advice to the contrary from Shewhart and others who have studied the problem carefully, many quality control operators have thought that they could avoid this first stage of control chart operation. In general, such a procedure is not wise.

It is true that the people at Maytag did spend considerable time in the preliminary stage achieving a controlled process as well as a desired probability of type I error. They also realized that use of the MDLC led to the taking of greater risks than with the conventional $\bar{X}$, R chart. However, they still decided to adopt the MDLC in several areas of manufacture in preference to the $\bar{X}$, R chart for the following reasons:* (a) An inspector can plot 50 percent more charts if the MDLC is used in place of $\bar{X}$, R charts. (b) The MDLC is more easily understood by operators. The quality control personnel at Maytag felt, and still feel, that the economic gains realized by using the MDLC in certain applications in preference to the conventional $\bar{X}$, R charts outweigh the greater risks you run of "accepting" undesirable production. Perhaps, in view of the human element present in so many production processes, they have recognized (and tried to combat) a situation which could do with more study by those concerned with such problems.

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*Personal communication from Mr. G. A. Helberg.

Argus Sequential Sampling

A. A. PROCASSINI and R. L. CLARK

Argus Cameras, Division of Sylvania Electric Products Inc., Ann Arbor, Mich.

As in many other organizations, Argus found at the time statistical quality control was introduced that MIL-STD-105A was a readily obtainable and easy-to-use sampling plan. Over a period of five years, we have found the operating characteristic curves to be adequate. During this time, the multiple sampling plan of MIL-STD-105A was used.

It seems, however, that when the MIL-STD-105A Multiple Sampling Plans were designed, one of the primary goals was ease of administration rather than economy. This led us, in 1955, to review our use of MIL-STD-105A. On examination we found that with the lot sizes received (average size was 7000 units) and the Acceptable Quality Levels in use, i.e., 1, 2.5, 6.5 and 10 percent —we would reduce inspection labor by the use of a pure unit sequential sampling plan. We also decided to maintain as closely as possible, the operating characteristic curves of MIL-STD-105A.

By inspection of the operating characteristic curves of MIL-STD-105A and the use of Table 2.23 in *Sequential Analysis of Statistical Data: Applications* by the Statistical Research Group, Columbia University, 1945, Columbia University Press, closely approximating values were chosen for p_1 and p_2 for $\alpha = 0.05$, $\beta = 0.10$, where

p_1 = Acceptable Quality Level

p_2 = Lot Tolerance Percent Defective

α = Probability of rejecting a lot of p_1 quality.

β = Probability of accepting a lot of p_2 quality.

A table was then made which gave the factors necessary to construct the unit sequential plans. A portion of this table, which includes the values taken from Table 2.23 referred to above, is shown in Table I. The values of p_1 and p_2 in Table I may be compared with those that give $\alpha = 5\%$, $\beta = 10\%$ for the single sampling operating characteristic curves shown in MIL-STD-105A. These values were then used with the equations necessary to compute the Argus tables. The equations are:

$$d_2 = h_2 + sN$$

$$d_1 = -h_1 + sN$$

where

N = cumulated sample

d_2 = Rejection number

d_1 = Acceptance number

From the computations, the Argus Tables were constructed. Portions of the preliminary and the final tables are shown in Table II. It should be noted that the final tables have been shortened by showing only the combinations of sample size, acceptance number and rejection number where a change in acceptance and/or rejection number takes place.

The Argus Table is used as a unit sequential, although it is printed in a condensed form. For example, in the Argus Table where N = 23, A = 0, R = 8, the acceptance and rejection numbers remain at 0 and 8 for N = 24, 25, 26 and 27.

The savings by use of this plan without substantially changing our risks are shown in Table III. For lots of very low or high percent defective and an equal proportion of the four AQL's used, the Argus Table M results in approximately a 35 percent reduction in sampling. If lot quality is approximately midway between p_1 and p_2 it is possible that a savings may not be realized. This can be shown by plotting average sample number against percent defective for a multiple sampling plan and a unit sequential plan having the same values for p_1, p_2, α, and β. It should also be noted that as the AQL becomes greater, the initial sample size decreases because the initial acceptance number remains zero for each AQL.

TABLE I

Min. Lot Size	Max. Lot Size	AQL (in fraction defective)	p_1	p_2	h_1	h_2	s
Table M 3201	8000	0.010	0.0075	0.040	1.3186	1.6930	0.01950
		0.025	0.030	0.080	2.1778	2.7960	0.13670
		0.065	0.070	0.140	2.9185	3.7469	0.05119
		0.100	0.100	0.180	3.3065	4.2451	0.10140

TABLE II

Tabulated Listing Table M — 10% AQL						Argus Sequential Sampling Tables Table M — 10% AQL		
N	A	R	N	A	R	N	A	R
1	—	5	20	—	7	5	—	5
2	—	5	21	—	8	6	—	6
3	—	5	22	—	8	13	—	7
4	—	5	23	0	8	21	—	8
5	—	5	24	0	8	23	0	8
6	—	6	25	0	8	28	0	9
7	—	6	26	0	8	30	1	9
8	—	6	27	0	8	35	1	10
9	—	6	28	0	9	37	2	10
10	—	6	29	0	9	etc.		
11	—	6	30	1	9			
12	—	6	31	1	9			
13	—	7	32	1	9			
14	—	7	33	1	9			
15	—	7	34	1	9			
16	—	7	35	1	10			
17	—	7	36	1	10			
18	—	7	37	2	10			
19	—	7	etc.					

A study of the proportion of Acceptable Quality Levels and Lot Sampling Records showed that we could expect a 20 percent reduction of inspection time in receiving inspection. This reduction was realized.

The termination point of our sampling plans are either 3 $\bar{n}_{p_1}$, 3 $\bar{n}_{p_2}$, or the single sampling number, whichever is the least. A third termination at the single sampling point will increase the probability of acceptance; however if it is not much smaller than the smallest of 3 $\bar{n}_{p_1}$ or 3 $\bar{n}_{p_2}$, the increase will be small.

The Argus Tables are completely sequential from a lot size of 181 in tables corresponding to those of MIL-STD-105A. The tables cover the Acceptable Quality Levels of 1, 2.5, 4, 6.5 and 10 percent.

We feel at Argus that this step we have taken allows us to be both compatible with other organizations using the widely accepted MIL-STD-105A and to experience greater economy of operation.

TABLE III

MIL-STD-105A (Lot size 3201 — 8000 — Table M Multiple Sampling)		Argus Sequential Sampling (Lot Size 3201 — 8000 — Table M)	
AQL	Initial Sample Size for Acceptance	AQL	Initial Sample Size for Acceptance
1%	100	1%	68
2.5%	50	2.5%	43
6.5%	50	6.5%	29
10%	50	10.0%	23
	250		163

A copy of these Tables, including p_1 and p_2 values for each plan, may be obtained on request from William E. Courtright, Director of Quality Control, Argus Cameras, Division of Sylvania Electric Products Inc., Ann Arbor, Michigan.

SUPERVISOR'S CIRCLE

PAUL A. ROBERT, *Editor*

Gruen Watch Company, Time Hill, Cincinnati, 6, Ohio

A Systematic Procedure For Installing Quality Control In A Production Department

R. B. NOTTINGHAM, *Brush Electronics Company, Cleveland, Ohio*

There are various approaches to the installation of quality control, ranging from the "squeaking wheel" philosophy where control is installed only when the noise of complaint is deafening, to the "blanket" philosophy where a control chart is hung on everything that stands still.

Over a period of years, we have evolved a philosophy which leads to a systematic approach. In this approach, we have tried not only to achieve the desired end results, but to achieve them with maximum efficiency.

This approach is outlined in the following sixteen steps:

1. If plant personnel are not familiar with QC, see that a training program is established to accomplish this.

   If the plant has a training department, work with them to develop this program. If not, it probably becomes a Do-It-Yourself project. Try to synchronize training with the development of the QC program; for example, the techniques of QC should

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probably not be presented until the information from Steps 1-7 is available for motivation.

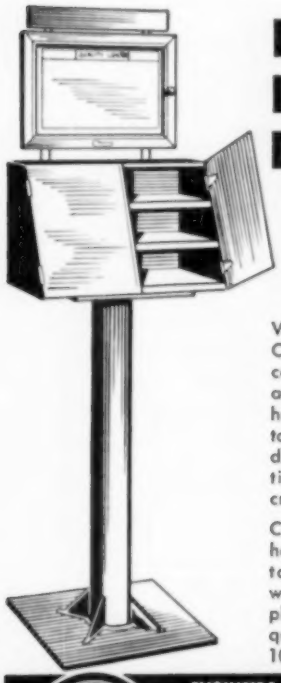
2. Establish an adequate record system to record all scrap and rework, both final and in process.

   You may be one of the fortunate ones who operate in a company where such records are already kept and may be trusted. However, you may be in a company like the New England company where the machinist threw all scrap parts out of the window into a convenient river. Or, you may find processes where inspection is returning rejected material to production for rework without benefit of a rework work order. Case #1 may be detected by an input-output analysis. Compare the input to the department with the output of the department and see how well scrap records account for the difference. For Case #2, insist that no material leaves the custody of inspection except on a delivery to stock, delivery to another department or on a rework work order. Do not believe any records of this type without an audit.

3. Obtain the best possible estimates of the cost of scrap and rework.

   Once Step #2 is completed, this should not be too difficult. If cost accounting is not costing scrap tickets, see that this is done. If it is being done, verify the way it is being done. Analyze the labor and material being charged to rework orders: test for accuracy.

4. Determine the one or more items which are contributing chiefly to scrap and rework costs.



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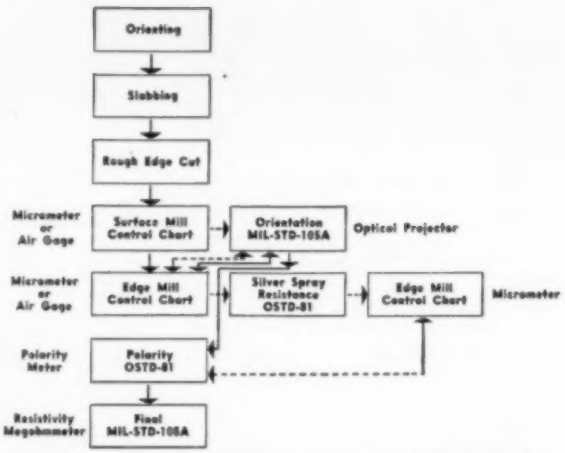

Figure 1—Flow Chart of Operations Required for Bedford PN Plates

   Go back one year if records permit, or, if not, as far as possible. Tabulate the cost of scrap and rework by product.

5. Determine whether any items are serious sources of customer complaint.

   Determine whether the customer service department, sales department or some other group records all customer complaints. If not, work to establish such a system and analyze complaints over some time base. This may be complaints on products in warranty, complaints in the first year of service, or on some other base.

   If material moves from one department to another, see that complaints from following departments are recorded. Analyze these complaints by product or part.

6. Establish a record system adequate to identify for these items the properties which are causing scrap and rework or complaints.

   Analyze these records carefully.

7. Prepare flow charts showing production and inspection operations.

   If the product requires more than a very few operations, establish a flow chart (see Fig. 1) showing all production operations and calling out the inspection operations. These call outs should include the type of inspection, the specifications to be met, and the gages or test sets required.

8. Establish the necessary control charts to determine the state of control of these properties. In most instances, the process will not be in control.

   Establish control charts for variables ($\bar{X}$ & R), if possible; if not, use p or c charts.

9. Determine the adequacy and efficiency of inspection methods and improve, if necessary.

   If attribute inspection is now being used, can variables inspection be used more profitably? If variables inspection is used, is it reliable to 1/5th to 1/10th of the tolerance? Are production and inspection gauges or test sets checked or recalibrated frequently enough?

Challenge the efficiency of the inspection method. If you have a methods engineering department, ask them to make suggestions for increasing inspection efficiency.

10. Determine the assignable causes producing poor control.

    This may not be easy. It will certainly require full cooperation of the production supervisor. He is in a much better position than you to detect the cause of a shift in a control chart, if the chart is where he cannot fail to see it, and if he understands it. If the chart covers the output of more than one operator or machine, it may be necessary to install subcharts to detect the sources of trouble.

11. Eliminate these causes.

    There may be instances where it is unnecessary to bring a process into strict statistical control if the process is operating well within tolerances. In these cases, reject limits may be used. It is usually within the power of the supervisor to obtain a state of control. He must be sold on its importance.

12. If, when the process is in control, it does not meet specifications, investigate the basis for the specifications.

    This is important—are the specifications based on an actual customer or functional requirement, or do they only reflect someone's opinion of what the process should do? If the latter is the case, produce evidence to establish the process capability when it is in control.

13. If the specifications are justified, present to management a proposal for investigation and improvement of methods.

    This presentation should be wholly practical and supported by statistical evidence.

14. When the reject level of the principle items has been reduced to an economic value, investigate all remaining items in order of importance which show an appreciable percentage defective. Repeat Steps 4 through 12.

    There comes a time to know when to quit. This is, of course, when the cost of eliminating a problem is greater than the cost of allowing the problem to exist.

15. When all items have been brought to negligible rejection levels, maintain surveillance.

    Don't relax. New products, operations and processes will keep you busy. Try to extend the statistical techniques of quality control into quantitative decision problems other than inspection.

16. Keep smiling.

    The smiling QC salesman usually wins.

    Read "Quality Control from Bench to Budget" by Frank H. Squires in the 1957 ANNUAL CONVENTION TRANSACTIONS available from the National Office at $3.50 per copy. (See page 38 for order blank.)

The writer wishes to express his gratitude to J. M. Juran, his co-workers, and many others who, through personal contact and their writings have aided in the development of this approach.

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PROGRAM

THURSDAY

9:30-10:30

Introduction: Welcoming address, Thomas H. Coulter, Chief Executive Officer, Chicago Association of Commerce and Industry.

Welcome to Chicago, Honorable Richard J. Daley, Mayor of Chicago.

Quality and Automation, Dr. J. T. Rettaliata, Pres., Illinois Institute of Technology.

(1) 10:40-12:00

A. Our Qualityproduction Program, James L. Coburn, Factory Manager, Kawneer Co., Aircraft Products Div., Niles, Michigan.

B. Experimental Analysis in the Chemical Field, Dr. Lindson P. Anderson, Associate Director of Food Research, Armour and Co., Chicago, Illinois.

C. Quality Control in a Petroleum Refinery, John B. Cobb, Research Dept. Group Leader, Standard Oil Co. (Ind.), Sugar Creek, Missouri.

D. We Did It—and We're Glad, A. H. Benscoter, Director, Quality Control, A. O. Smith Corp., Permaglass Div., Kankakee, Illinois.

E. What is Statistical Quality Control?
Interpreting Industrial Data.

12:15-2:15

Luncheon: Utility Profits From Quality Control, Titus G. LeClair, Manager, Research and Development, Commonwealth Edison Co., Chicago, Illinois.

(2) 2:30-3:50

A. Quality Control and Human Relations in Electronics, Irwin H. Pollack, Quality Control Manager, Ohmite Manufacturing Co., Skokie, Illinois.

B. Mating Parts Tolerances—Practical and Theoretical, Prof. Irving W. Burr, Professor of Mathematics, Purdue University, Lafayette, Indiana.

C. A New Look at a Quality Control Program, Walter F. Blickle, Manager, Quality Control, Cummins Engine Co., Inc., Columbus, Indiana.

D. Plastics in Industry, Philip G. Fleming, Asst. Sr. Eng., Materials Engineering, Bendix Aviation Corp., Kansas City, Missouri.

E. Average and Range Charts from a Constant Cause System.
Average and Range Charts for Process Control.

(3) 4:10-5:30

A. Reliability Results from Large Scale Testing, David Bair (Manager), Paul Gottfried (Project Director), Inland Testing Laboratories, Morton Grove, Illinois.

B. Experimental Designs and Variance Components, Dr. A. W. Wortham, Chief of Operations Research, Texas Instruments, Inc., Dallas, Texas.

C. Quality Control and Management, Walter S. Oliver, Consultant, Chalmette, Louisiana.

D. Planning, Quality Records, Action Create Efficiency, Ralph D. Humphries, Inspection Supervisor, Cessna Aircraft Co., Wichita, Kans.

E. Frequency Distributions and Control Charts
—Process vs. Product.
—Normal Distribution.

FRIDAY

(4) 9:00-10:20

A. New Dynamics in the Applications of Statistics in Industrial Experimentation, Dr. J. Stuart Hunter, Research Associate, Princeton University, Princeton, New Jersey.

B. Some Useful Nonparametric Methods, Prof. W. Allen Wallis, Dean, School of Business, University of Chicago, Chicago, Illinois.

C. Completely Integrated Quality Control Pays Off, William S. Jolitz, Quality Control Engineer, Goodyear Tire and Rubber Co., Lincoln, Nebraska.

D. Machine Capability vs. Product Tolerance, Edward Oakley, Supervisor Quality Control, Delco-Remy Div., GMC, Anderson, Indiana.

E. Control Chart for Fraction Defective.
Other Attribute Charts and Their Use.

(5) 10:40-12:00

A. New Dynamics in the Applications of Statistics in Industrial Experimentation, (continuation of earlier session) Dr. H. P. Andrews, Statistician, Research Laboratories, Swift & Co., Chicago, Illinois.

B. Container Metallurgical Problems —Statistical Methods, Miss MacGoodwin Tarver, Statistician, Container Research and Development, Continental Can Co., Inc., Chicago, Illinois.

C. Statistical Quality Control, Applications of Short Runs, Herschell R. Harrison, Quality Control Manager, Collins Radio Co., Cedar Rapids, Iowa.

D. Measuring a Continuous Variable by Attributes in Rocket Field, O. R. Weaver, Manager, Quality Control Branch, Phillips Petroleum Co., Rocket Fuels, McGregor, Texas.

E. Fundamentals of Acceptance Sampling.
How and Why Modern Sampling Plans Work.

12:15-2:15

Luncheon: Quality Control is no Sleight-of-Hand Fly-by-Night Program, Dr. Preston Digitator, The Flying Carpet and Rug Co.

(6) 2:30-4:00

A. B. C. D. Statistical Smorgasboard, Led by Dr. L. A. Knowler, State University of Iowa, Program Chairman.

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section briefs

ALLENTOWN-BETHLEHEM . . . Come one, come all, to course number 4, "Analysis of Variance with $\bar{X}$ and R Charts," in eight action packed sessions, taken one each week to keep the gremlins away. Don't miss the scintillating instruction of Ken Stephens, Wes Sawyer, and Dave Hilder.

BALTIMORE...The executive Committee met on July 24 and approved a fine program for the entire coming year, the opening of which will take place on Oct. 2.

Plans are well advanced for a renewal of the Baltimore-Washington one-day conference to be held in Baltimore. These past conferences have greatly stimulated interest and new memberships and aided maintenance of financial solvency of the two sections.

BINGHAMTON . . . A tour of Ansco, a Division of General Aniline & Film Corp., is scheduled for October 8 at 6 pm. The speaker will be M. G. Anderson, manager of quality control at Ansco. There will be a dinner at 7:30 at the Ansco Cafeteria.

BOSTON . . . The convention committee under the able leadership of Warren Grosjean is well organized and is paving the way for a successful 1958 convention in Boston. We ask all to start planning now to be in Boston next year.

BUZZARDS BAY . . . Kenneth Bennett presided at the July 23 executive board meeting at the Continental Screw Co. A membership drive was planned.

CHICAGO . . . At the Sept. 23 meeting a topic will be presented which should be of interest to all who are striving to interest management in statistical methods. "Management opinions of quality control" will be a must because, presented by a production vice president, we are placed on a different side of the fence.

CINCINNATI . . . In July several executive committee meetings were held, one was a joint meeting with the Hamilton-Middletown section.

On Oct. 16, Dr. Charles Hicks, Purdue University, will speak on "Statistics applied to industrial engineering." This will be a joint meeting with the AIIE and the senior class of the University of Cincinnati, Engineering College.

COLUMBUS . . . The October meeting will consist of a plant tour of the Whirlpool Corp., Marion, Ohio. Members taking the tour will have an opportunity to observe test procedures employed on an automated assembly line.

CUMBERLAND . . . Newly elected officers for 1957-58 are: chairman—Robert E. Hunter; vice chairman—Walter R. Edwards; and secretary-treasurer—Leonard J. Murphy; all are with Celanese Corporation of America. The new executive committee plans an expansion of section activities, starting with a shrimp-and-beer party in August, to stimulate interest and increase membership.

DALLAS-FORT WORTH . . . In executive session July 25, appointments to handle chapter functions for the coming year were finalized and plans for future programs proposed.

Dr. A. W. Wortham, chairman, had an all-day planning session for the executive committee at his home on Aug. 24.

DAYTON . . . Announcement of section officers: chairman J. C. Sollenberger, Chrysler-Airtemp; vice chairman Arnold Lochner, Frigidaire; secretary John M. Stanch, Leland Electric Co.; treasurer, James Cogar, Chrysler-Airtemp.

EVANSVILLE-OWENSBORO . . . An organizational meeting was held at Gabe's Steak House in Owensboro in September.

For the October meeting, the traveling exhibit of the DoALL Company of Des Plains, Illinois, titled "The Story of Measurement" will be presented. This will be a joint meeting with the ASTE and will be held at Evansville College on Oct. 15.

HAMILTON . . . On Oct. 8 the "Quality Control for Management" seminar, conducted by W. A. MacCrehan, Bendix Radio, Baltimore, Md., will be held at Fisher's Hotel, Hamilton.

HARRISBURG . . . Although the regular meetings are not held during the summer months, all the committees have been busy lining up an interesting program for the coming year. Chairman C. W. Bosey, AMP, Inc., has engaged speakers of various backgrounds to headline a banner year.

INDIANAPOLIS . . . The section has had meetings with people in both Kokomo and Bloomington in an endeavor to establish subsections in those areas.

The Oct. 9 meeting will be a joint meeting with ASA. Dr. Burr of Purdue University will talk on "Trends in engineering statistics and quality control."

LOS ANGELES . . . The Los Angeles section visited Hughes Aircraft Corp., El Segundo plant. This is the most modern electronic plant of its type.

On Oct. 15, the section will host General J. D. Caldera, Director of Flight Safety, USAF.

LOUISVILLE . . . E. M. Schrock will speak on "Management's goal for quality control" at the management night dinner on Oct. 14.

The program committee for this year has been on the ball and as a result the program for the entire year was practically completed prior to Aug. 1.

MICHIGAN . . . The first of the fall meetings will start with a dinner and tour of the General Motors Technical Center, Warren, Mich. The main speaker for the evening will be the well known A. V. Feigenbaum. The meeting will consist of four groupings—management, engineering, inspection & testing, materials—each of which will discuss problems concerning them. This will also be a joint meeting with the American Society for the Advancement of Management. Dinner will be served at 6:30 p.m. and the tour will be from 7:30-8:45 with the meetings getting underway at 9 p.m.

MID-HUDSON . . . A. U. Sternlof, QC supervisor of American Steel & Wire, Worcester, is guest speaker for the October meeting. His subject will be "QC in the wire industry."

MILWAUKEE . . . An executive committee meeting was held at Marquette University on July 2. Chief item of the agenda was the coming season's program. It will be highlighted by an address by Sir Ronald Fisher at the October meeting which will be held in conjunction with ASA and many of the local colleges.

The educational series will also be continued this year with an intermediate course and a "cookbook" course.

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SECTION CALENDAR (SEPTEMBER 20—OCTOBER 19)

SECTION	DATE	PLACE	TIME	SUBJECT	SPEAKER
Allentown-Bethlehem	Sept. 23	Muhlenberg College	7:00 pm	First Session of Course No. 4, "Analysis of Variance with X and R Charts	
	Oct. 16	Walps Restaurant, Sigma Room	6:30	"Quality Control in the Electronics Industry	Leon Bass, General Electric Co.
Baltimore	Oct. 2		8:30	Administering a Quality Control Program	Leo. J. Jacobson, International Resistor Corp.
Binghamton	Oct. 8	Ansco	6:00	Tour, Speaker, Dinner at 7:30	M. G. Anderson, Ansco
Buzzards Bay	Oct. 8	Conference Room, Continental Screw Co.	8:00	Monte Carlo Key to New Methods	James L. Dolby, General Electric Co.
Chicago	Sept. 25	Lawson YMCA, 30 W. Chicago	6:00	Management Opinion of Quality Control	Bernard G. Sahlins, Pentron Corp.
	Oct. 1	Wahl-Henius Institute	7:00	Beginning Advanced Education Series	
	Oct. 3	Room 218, Navy Pier	7:15	Beginning Elementary Education Series	
Cincinnati	Oct. 16	Engineering Society Headquarters	8:00	Statistics Applied to Industrial Engineering	Dr. Charles Hicks, Purdue University
	Oct. 1			Fall Series of Educational Courses, 10-12 weeks	Intermediate and Advanced Courses
Columbus	Oct. 16	Whirlpool Corp., Marion	8:00	Plant Tour	
Corning-Elmira	Oct. 8	Elmira	8:00		
Dallas-Fort Worth	Oct. 17	Arlington State College	8:00	Quality Assurance	C. E. Fisher, Bell Telephone Labs
Evansville-Owensboro	Oct. 15	Evansville College	6:00	The Story of Measurements Exhibit	
Hamilton	Oct. 8	Fisher's Hotel		Quality Control for Management Seminar	W. A. MacCrehan, Bendix Radio
	Oct. 17	Westinghouse Auditorium	8:00	Quality Control in the Can Industry	E. E. Allan, American Can Co.
Indianapolis	Oct. 9	Butler University	6:30	Trends in Engineering Statistics and Quality Control	Dr. Irving W. Burr, Purdue University
Kansas City	Oct. 17	Blue Hills Restaurant	7:00		
Los Angeles	Oct. 15				General J. D. Caldera, USAF
Louisville	Oct. 14	American-Standard	6:00	Management's Goal for Quality Control	E. M. Schrock, American Radiator & Standard Sanitary Corp.
Michigan	Sept. 20	GM Tech Center	6:30	Total Quality Control	A. V. Feigenbaum, General Electric Co.
Mid-Hudson	Oct. 1	Anchor Inn, Poughkeepsie	7:00	QC in Wire Industry	A. U. Sternlof, American Steel & Wire Co.
Montreal	Oct. 16	C.I.L. Building	8:00	Quality Control Pays Off in Woodworking	Robert Chateauneuf, Singer Sewing Machine Co.
Philadelphia	Sept. 20	Drexel Institute of Technology		Quality Methods and Management	
Rochester	Oct. 15	Chamber of Commerce	6:15	Joint Meeting with Industrial Engineering Society	Dr. Adam Abruzzi
St. Louis	Sept. 20	Golden Fried Chicken	6:30	Quality Control in a Petroleum Industry	John B. Cobb, Standard Oil Co.
Scranton-Wilkes-Barre	Oct. 8	Castle Restaurant, Scranton	6:30	Process Capability from Machine to Industry	D. H. W. Allan, American Iron & Steel Institute
South Bend-Mishawaka	Oct. 3	YMCA, South Bend	7:30	Quality Control Problems Forum	Round Table Impromptu Discussion
	Oct. 17	YMCA, South Bend	7:30	The Mathematical Theory of Quality Control	James E. Sorenson, Aeronica Mfg. Corp.
South Texas	Oct. 9	Texas State Hotel, Houston	7:00	Quality Assurance	C. E. Fisher, Bell Telephone Labs
Toledo	Oct. 10	Angelo's Restaurant	6:30	How to Organize a Quality Control Program That Pays	Harmon S. Bayer, Consultant
Toronto	Sept. 25	Rexdale	7:30	Plant Visit, C.S.A. Testing Lab	
	Oct. 9	University of Toronto	7:30	Statistical Methods as Applied to Engineering Standards	N. P. Demos, General Electric
Univ. of W. Ontario	Oct. 16	Kitchener			
Winnebago	Oct. 14	Appleton Elk's Club	7:30	Some Considerations in the Reel Sampling of Paper	Maynard S. Renner, Dewey and Almy Chemical Co.

MONTREAL . . . Robert Chateauneuf of the Singer Sewing Machine Co. will talk on "Quality control pays off in woodworking." The meeting will be held in the C.I.L. Building conference room.

PHILADELPHIA . . . The section, together with Drexel Institute of Technology, will again hold their popular annual symposium on "Quality methods and management" on Sept. 20. Outstanding speakers will present topics of interest to many which include vendor-vendee relations, reliability, purchasing and quality control, standards engineering and quality control, human engineering in quality control, value engineering, Monte Carlo applications, and assumptions in everyday statistics. The luncheon speaker will be Leon Bass, ASQC President. The meeting will coincide with the regular monthly dinner meeting of the section at which time Dorian Shainin will be the guest speaker.

Further details may be obtained from George Nimick, Box 7409, Philadelphia 1, Pa.

ST. LOUIS . . . The section has planned their annual one-day conference for Thursday, Oct. 3, at the Olin-Mathieson plant at E. Alton, Ill. In conjunction with the conference will be a conducted tour of the ammunition division.

At the meeting for Oct. 18 we have planned a management meeting. The subject will be "A manager examines statistical quality control." The speaker will be C. E. Heitman, president of Carter Carburetor Division of A. C. F.

SAN BERNARDINO . . . An active drive for new members is being conducted beginning with the September meeting. At present, the section has 72 members. Brochures stating the ASQC goals and activities and the section's program for the coming year are being sent to 2000 non-members.

The extended day division of Mount San Antonio College in Pomona, Calif., is conducting a two semester course in basic statistical quality control commencing in September. Statistical theory and methods are to be presented with emphasis placed on the practical application of these in the aircraft and related industries. The course will be presented in three-hour sessions, one night a week. It is being sponsored by the California Adult Educational Department and there is no enrollment or tuition fee. Tests will be "Statistical Quality Control" and MIL-STD-105A.

SOUTH BEND-MISHAWAKA . . . "Quality control problems forums" is a 1957-58 innovation announced for the South Bend-Mishawaka section by Joseph F. Gyoles, forum committee chairman. The first of the four scheduled sessions is to be held at 7:30 pm on Oct. 3 in the South Bend YMCA.

The purpose of these meetings, according to Mr. Gyoles, is to offer the members of our section and other interested persons of this locality the opportunity to freely and informally discuss their quality control problems and exchange ideas.

SOUTH TEXAS . . . Society vice president C. E. Fisher will speak to a joint meeting of the section and the Houston section of AIIE in October.

SOUTHERN CONNECTICUT . . . The section has concentrated its attention on the 11th New England Conference. As host section, a special effort is being made to assure an enjoyable and informative conference.

TOLEDO . . . The section is sponsoring an eight-week course "Basic statistical quality control" at the University of Toledo beginning Oct. 7 covering sampling, control charts for variables and attributes, and practical applications. Dr. Julian H. Toulouse, Merrit A. Gates, Mel. E. Lindner, and Nelson G. Meagley will be the instructors. All are trained men in SQC techniques. Messrs. Toulouse, Gates, and Lindner are Toledo section members and employees of Owens-Illinois. Mr. Meagley is a Michigan section member and is employed at Lincoln Motors.

TORONTO . . . A golf tournament sponsored by the section will be held on Sept. 21 at the Ajax Golf Club.

Harold Kempling is improving steadily from his accident and we wish him a speedy and complete recovery so that he may start in his new position. Due to his job promotion, Miss Joan Wheler has been selected to fill his unexpired term as section secretary.

UNIVERSITY OF WESTERN ONTARIO . . . In an executive meeting July 11 further progress was made in finalizing this year's program. Four speakers have been arranged.

WESTERN MASSACHUSETTS . . . The first meeting will be held Sept. 10 when C. W. Carter, Rath & Strong of Boston and a past president of the section, will speak on "Quality improvement through statistical engineering."

WINNEBAGO . . . Members are looking forward to Maynard Renner's address on "Some considerations in the reel sampling of paper." Since reel sampling is a highly discussed manufacturing point, the address appears timely and interesting.

Plans for a one-day clinic are moving ahead rapidly. The event, if held, will be the first by the section.

WORCESTER . . . The section is starting the new season with a "Suburban Area" meeting at the Westboro Country Club to stimulate membership.

. . . SIGNIFICANT DIFFERENCES

. . . Baltimore—D. H. Taylor, Bendix Frieze Corp., will, in addition to his regular job, be a member of the faculty of the McCoy College evening school of the Johns Hopkins University. He will present a course entitled "Principles of industrial quality control."

. . . Boston—Frank Satterthwaite, who is associated with Rath & Strong of Boston, has now added to his duties by

J. CLAYTON KNAPP

It is with extreme sorrow that we report here the sudden death of J. Clayton Knapp on August 12, 1957. While on a business trip to Windsor, Ontario, Clayt had retired for the night at the home of his mother and passed away during the night. He was forty-six years old and apparently in the best of health.

Clayt was born in Ingersoll, Ontario and received his primary education in that town. He received his bachelor of science degree in mechanical engineering at the University of Toronto in 1934.

After several years with other automobile manufacturers, he joined the Ford Motor Company of Canada in Windsor in 1938 as a member of its service department. He received various promotions serving as draftsman, engineer, and inspector. In 1947 he installed the statistical quality control department and headed that department at the Windsor plant. In 1956 he was appointed Manager of the Quality Control Department, Manufacturing Staff, Toronto, which position he held at the time of his death.

Clayt was a member of the Michigan Section of ASQC and he held numerous offices before and after his term as chairman of the section in 1951-52. He also served the Society in various capacities, such as being a member of the nominating committee for the Shewhart Medal. He was one of the original members of the 11th Convention Committee (Detroit, 1957) and served as co-chairman of its program committee. He was one of the founders of the Automotive Division and was its chairman in 1955-56. Clayt was in demand as a speaker and had lectured both in the United States and Canada at section meetings and before university gatherings.

Clayt is survived by his widow, Jeannette; his son, James; and his mother, Mrs. William Scott.

Funeral services were held at the Anderson Funeral Home and internment was at Heavenly Rest Cemetery, Windsor on August 14, 1957.

The Society and the community have lost a dependable and hard worker, an honest and loyal individual, a warm and generous personality, and a capable and inspiring leader.

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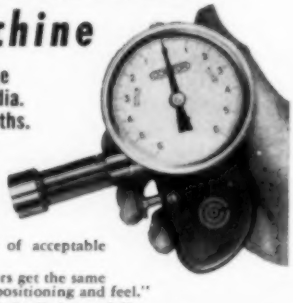

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joining The Merrimac College Faculty at Andover as associate professor of mathematics.

. . . Cincinnati—George Krenek has taken a position with the Flight Propulsion Laboratory Department of General Electric Co., Evendale, as supervisor of quality control engineering.

W. L. Eilrich, Jr., formerly of the Chicago section and a member of the nucleus group which organized the Fox Valley sub-group, has transferred to our section. Bill was formerly director of quality control for Cruver Mfg. Co., Chicago, and has taken a position with the aircraft gas turbine division of General Electric as a quality control engineer.

. . . Corning-Elmira—Jack Cherry has been appointed superintendent of manufacturing, special purpose power tubes, Westinghouse, Elmira. Mr. Cherry served as section chairman during 1955-56.

Robert Myers has been appointed supervisor of quality control, power tubes, Westinghouse, Elmira.

. . . Cumberland—Recent senior quality engineer appointees at the Amcelle plant of Celanese Corporation of America are George H. Fisk and Byron A. Bonebreak. Mr. Fisk leads the Standards Department; Mr. Bonebreak directs the Cellulose Compounds QC Department.

. . . Dallas-Fort Worth—Dr. A. W. "Bill" Wortham, chairman of the section, recently joined Texas Instruments, Inc., to head the operations research program in their semiconductor-components division.

. . . Dayton—Vice chairman Arnold Lochner has been promoted to the position of quality control engineer with the Frigidaire Division of GMC.

Section secretary John M. Stanch has left Inland Division, GMC, and is now with the Leland Electric Company.

. . . Harrisburg—Clifford S. Charles, AMP, Inc., has been promoted to and has assumed company wide duties reporting to the vice president and director of operations. C. William Brosey, AMP, Inc., has been named to replace Mr. Charles as supervisor of quality control for the general products division.

. . . Los Angeles—Irving Quart, publicity chairman, has joined Hydro-Aire, Inc., Burbank, as a quality control engineer.

The promotion of Jack S. Kinney to manager of statistical quality control for McCulloch Motors Corp., was announced recently by C. A. Peterson, director of quality control.

. . . Metropolitan—John J. Halsey has been appointed to the newly created position of manager of quality services at General Foods Corp., White Plains, N. Y. Mr. Halsey was formerly with Merck & Co., Inc., Rahway, N. J.

. . . Mid-Hudson—William M. Cranston spoke on "Quality control in the graphic arts" recently at the 38th annual convention of the International Association of Printing House Craftsmen, Inc., at Buffalo, N. Y.

. . . St. Louis—Two members have received promotions at the Ramsey Corp. Simon D. Krasner has been promoted to quality control manager. Joseph Movshin, Bibliography editor of **Industrial Quality Control**, has been promoted to industrial engineering manager.

. . . South Bend-Mishawaka—John Atkins, formerly chief inspector for the Naval Inspector of Ordnance at the Bendix-Mishawaka Missile Plant has accepted a position as a member of a four man operation research team reporting to the commanding general at Patrick Air Force Base.

. . . Toledo—Matthew Bowers, general quality control manager of the L.O.F. Glass Fibers Company, has been promoted to process control manager of the company's Corrulux Division, Houston, Texas.

. . . Toronto—Harold Kempling has accepted the position of manager, quality control, with Raytheon of Canada in Waterloo, Ontario.

. . . Winnebago—Program chairman Jack Chinn has recently been named assistant to the paper machine superintendent for Consolidated Water, Power and Paper Co. at Wisconsin Rapids.

. . . Youngstown—Joseph C. Selby has been promoted to chief inspector and general foreman of the Canton and Gambrinus Bearing Plants of the Timken Roller Bearing Company, Canton. The position of assistant chief inspector, previously held by Mr. Selby, has been filled by Robert W. Dorn.

The Evansville-Owensboro section was grieved by the death of member Charles "Chuck" Singer at Owensboro, Kentucky, July 19. Mr. Singer was section vice chairman during 1956-57.

This is the scrap pile for a run of 400 Class 5 tolerance screws

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SEPTEMBER

. . . **23-25**—Twelfth Annual Conference, Petroleum Division, ASME, Hotel Mayo, Tulsa, Okla., contact Mid-Continent Section, ASME, Att: Carl A. Stevens, 1932 North Boston Ave., Tulsa 6, Okla.

. . . **23-25**—Sixth Annual Meeting, Standards Engineers Society, Hotel Commodore, New York, contact T. J. O'Connor, Room 5D-127, Bell Telephone Labs, Inc., Whippany, N. J.

. . . **27**—Regional Technical Conference, "Hot Runner Molding," Hotel Niagara Falls, N. Y., sponsored by Society of Plastics Engineers, Inc., contact R. W. Miler, 3 Hillview Center, Lewiston, N. Y.

OCTOBER

. . . **7-11**—Supervisory Development Course 2, given in three one-week units (Oct. 14-18, Nov. 11-15), Penn Sherwood Hotel, Philadelphia, sponsored by AMA, contact Course Registrar, American Management Association, Inc., 1515 Broadway, New York 36, N. Y.

. . . **8**—Regional Technical Conference, "Isocyantes," Curtis Hotel, Minneapolis, Minn., sponsored by Society of Plastics Engineers, Inc., contact Paul Becker, Honeywell Regulator Co., 2733 4th Ave., South, Minneapolis, Minn.

. . . **16-18**—Eleventh Annual New England QC Conference, Stratfield Hotel, Bridgeport, Conn., sponsored by the New England sections of ASQC, program details and registration forms can be obtained by writing to Carl W. Nickerson, Registration Chairman, c/o Wentworth Institute, Boston 15, Mass.

. . . **17**—Regional Technical Conference, "Polyethylene," Hotel Carter, Cleveland, Ohio, sponsored by Society of Plastics Engineers, Inc., contact W. A. Messina, 23817 Cliff Drive, Bay Village, Ohio.

. . . **18-19**—First Annual QC Technical Conference, Philadelphia, Pa., sponsored by the Chemical Division, ASQC.

. . . **24-25**—12th Midwest QC Conference, Chicago, Ill., sponsored by Midwest sections of ASQC, contact A. Jackson, Birtman Electric Co., 1800 N. Spaulding Ave., Chicago, Ill.

. . . **28-31**—2nd Winter Meeting, Henry Hudson Hotel, New York, N. Y., sponsored by American Nuclear Society, contact John Burt, J. M. Mathes, Inc., 260 Madison Ave., New York 16, N. Y.

NOVEMBER

. . . **6-8**—10th Annual Conference on Electronic Techniques in Medicine and Biology, Boston, Mass., sponsored by ISA and AIEE.

. . . **11**—Regional Technical Conference, "Plastics for Air-Borne Electronics," Ambassador, Los Angeles, Calif., sponsored by Society of Plastics Engineers, Inc., contact L. J. Costanza, 8017 Holy Cross Pl., Los Angeles 47, Calif.

. . . **18-22**—Second Annual Paperwork Simplification Conference, University of Dayton, contact University of Dayton, 300 College Park Avenue, Dayton 9, Ohio

. . . **18-21**—Air Conditioning & Refrigeration Exposition, sponsored by the Air Conditioning & Refrigeration Institute, International Amphitheatre, Chicago, Illinois, contact R. H. Israel, Sales Manager, Virginia Smelting Co., West Norfolk, Va.

DECEMBER

. . . **26-31**—American Association for the Advancement of Science, Indianapolis, Ind.

JANUARY

. . . **13-17**—Supervisory Development Course 3, given in three one-week units (Jan. 20-24, Feb. 24-28), Penn Sherwood Hotel, Philadelphia, sponsored by AMA, contact Course Registrar, American Management Association, Inc., 1515 Broadway, New York 36, N. Y.

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"Quality Control—The Proving Grounds For Tomorrow's Ideas"

NEW ENGLAND QC CONFERENCE

The New England sections of ASQC are co-sponsors of the Eleventh new England QC Conference to be held Oct. 16-18 at the Stratfield Hotel, Bridgeport, Conn. The theme of the conference is "Quality control—the proving grounds for tomorrow's ideas."

A series of "management seminars" will be aimed at initiating the new manager conferee as well as enlightening those repeating in attendance. Seminar leaders are Leonard Seder, James H. Davidson, and Dorian Shainin. Messrs. Seder and Shainin are well known quality control consultants and Mr. Davidson is equally well known as manager of statistical methods for General Electric. As in past years, the number of participants will be limited and will be accepted by advance registration only.

For those in the research or engineering fields, three topics by three top speakers will be offered. Dr. Robert Lusser, reliability coordinator for Redstone Arsenal, will present "The notorious unreliability of complex equipment." Along the same vein will be the topic "Control of complex assemblies," which is the subject of A. E. Aubin's address. Mr. Aubin is chief quality control engineer for Royal McBee Corp. Ervin F. Taylor, Atomic Fuel Dept., Westinghouse Electric Co., will present a topic that is not new but is a statistical expression of pre-statistical quality control intuitive sampling—"Discovery Sampling."

Cost and accounting specialists will be within their "limits" when A. C. Rosander, Internal Revenue Dept., presents "Quality control in accounting," as well as when "Direct savings from quality records" is presented by E. W. Ellis, United Aircraft.

These plus other subjects and speakers make a diversified program that should prove both beneficial and interesting to personnel from all levels of manufacturing operations.

Registration blanks and a program copy may be obtained by writing to Carl W. Nickerson, c/o Wentworth Institute, Boston 15, Mass.

ANNUAL REPORT
of the
BOARD OF DIRECTORS
American Society for Quality Control, Inc.

The Board of Directors of the American Society for Quality Control, Inc. submits herewith its Annual Report covering the 1956-1957 year from July 1, 1956 through June 30, 1957.

This report summarizes the outstanding events of the year and the more important decisions made by the Board and its Operating and Executive Committees as previously reported in the journal *Industrial Quality Control*.

BOARD OF DIRECTORS

The first meeting of the Board was held on June 7, 1956 at the Sheraton-Mount Royal Hotel, Montreal, Province of Quebec, Canada. This meeting was for the purpose of electing the five executive directors to serve for the year 1956-57. The men elected were:

Henry J. Becker
David G. Browne
Clarence R. Burdick
Paul S. Olmstead
Harry G. Romig

The mid-year meeting of the Board was held on November 17, 1956 at the Hotel Wisconsin, Milwaukee, Wisconsin. Of the business transacted perhaps that which had most significance for future development and operation of the Society was that related to the employment of our first Administrative Secretary, a proposal for membership dues increase, and general planning for more realistic budgeting of expense and income in our operation. Our Administrative Secretary was employed on November 15, 1957. The Board approved a recommendation that membership dues be increased from $10.00 to $12.00 for Members and from $12.00 to $15.00 for Seniors and Fellows to be effective July 1, 1957. This was submitted to the membership for final approval along with the Annual Ballot, and its defeat posed a very serious deterrent to Society planning. The objective of budget handling to place us on a current basis in respect to income and expenses reporting, was accomplished completely by July 1, 1957.

Of great importance for efficient operation in the future will be the move toward direct collection of dues by the Society's Headquarters' office in Milwaukee. This was thoroughly reviewed with the Board.

In recognition that advertising rates in our Journal, *Industrial Quality Control*, were below general market the Board concurred in an action to bring our rates more in line with other similar publications.

EXECUTIVE AND OPERATING COMMITTEES

During the year the Operating and Executive Committees met six times.

June 9, 1956, Montreal, Canada (Exec. Committee Only)
July 20, 1956, New York, N. Y.
September 29, 1956, Cincinnati, Ohio
November 16, 1956, Milwaukee, Wis.
February 1, 1957, Murray Hill, N. J.
April 12, 1957, Chicago, Illinois

Following the recommendations of a committee created to study operating relationships between the Executive and Operating Committees, it was decided to test the feasibility of having the two bodies meet in joint sessions. As you can see, this plan was followed on six occasions. The results of this experience are to be studied for the purpose of deciding what future policy should be for subsequent meetings of these bodies.

Following are the principal actions taken by these Committees:

1. A standing committee was established on International Cooperation to act as liaison group between the Society and other professional groups outside of North America (excluding Japan).
2. A uniform policy was endorsed to be used as a basis in deciding sites and general pattern of our annual conventions.
3. A pricing policy was enacted to ensure equitable monetary returns for efforts expended by the Society in making technical literature available to members and the public in general.
4. A specialized study was endorsed for the purpose of arriving at and placing in action methods to enhance the professional status of the quality control engineer and at the same time affect a broader recognition of this status. The study progressed well, and a high level committee has been activated implementing plans.
5. A general merchandising program was activated under special committee to spread publicity of ASQC beyond our own membership bounds. Targets here are increased recognition by such organizations as Rotary, Kiwanis, Lions Club, manufacturing associations, industrial development groups, etc.
6. A series of editorials to acquaint members with a wider knowledge of Society Operations was begun in *Industrial Quality Control* under the heading of "From the President's Desk." Material for these editorials is provided by all officers.
7. Our first Student Branch was recognized and activated in New York City.
8. Increasing recognition has been accorded to our six Technical Divisions and their importance to future development of the Society.
9. The Society was invited to select four of its members as candidates for possible selection on The National Science Foundation Board. Named were H. F. Dodge, G. D. Edwards, General L. E. Simon, and Dr. J. H. Toulouse.
10. Sections whose memberships represent about 50 percent of our total have signified a desire to go to direct collection of dues. This followed a successful test of the practice with four representative sections during the year.

ACKNOWLEDGEMENTS

The Board of Directors gratefully acknowledges the continued services of the Officers, Executive Directors, Division Chairmen, Technical Committee Chairmen, and Section Officers who contributed to the forward march of the Society.

Once again, too, the Board expresses its thanks to the Chairman of the Editorial Board and his associates for the fine journal, *Industrial Quality Control*.

The Society continues its forward strides with the many persons of different talents giving unselfishly of their time and energies to make our advance possible. Speakers, committee members, teachers, and many others have the sincere thanks of the Board.

Denver, Colorado
June 30, 1957

For the Board of Directors
DALE L. LOBSINGER, President

Appendix A: Report of the Executive Secretary

Membership

This year ASQC membership reached 10,495 for a new high. The net gain in membership this year is 822 which is only slightly less than it was last year. Following is a membership breakdown as of June 30, 1957:

Members	8413	Renewals	7571
Seniors	1881	New Members	2924
Fellows	201		
Totals	10495	Total	10495
Mem.-In-Tr.	93		

Renewals (7571) represent 78 percent of the previous year's membership. This rate maintains the pace set last year which is the best since 1952.

Since the last Annual Report the following new sections were established:

Section	No.
St. Catharines (Ontario)	92
Richmond (Indiana)	93
Kankakee-Joliet (Illinois)	94
Charleston (West Virginia)	95
Hamilton-Middletown (Ohio)	96
Lima (Ohio)	97

A petition for Section status from Phoenix, Arizona is awaiting completion of certain requirements. There is activity in St. Charles, Illinois, Rochester, Minnesota, Pensacola, Florida, North and South Carolina and inquiries from Battle Creek, Michigan and Staunton, Virginia.

An International Section has been conditionally approved which includes members in foreign countries other than Canada, Mexico, and Japan.

Headquarters Office

On November 15, 1956 William P. Youngclaus, Jr., was employed as our new Administrative Secretary. He brings to ASQC the experience and background in technical society administration which we needed so much. Much of the work heretofore done by the officer group has been taken over by Mr. Youngclaus and ultimately all administrative activity of the Society will be centered in the Milwaukee Office. We are fortunate in having as an office staff in addition to Mr. Youngclaus two very capable persons: George R. Foster, Managing Editor, and Miss Jean Truettner, Office Manager. They supervise a force of 7 clerks, bookkeepers and stenographers.

As the Society grows so does our space and personnel requirements. Next year we had hoped to add 300 square feet to the office and 2 extra persons. But the failure of the increased dues amendment made these additions unfeasible. Distribution of technical literature alone increased 250 percent over last year. We anticipate an increased work load from the direct collection of dues program because it is new and different. As time goes on the expected economies of the program will be realized.

Direct Collection of Dues

The officer group deeply appreciates the cooperation received from the Metropolitan, Chicago, Milwaukee, and San Diego Sections in theirs willingness to become "guinea pigs" by permitting us to experiment with direct dues collection this past year. From the experience we gained we have been able to plan next year's dues collection program more efficiently and economically. More than half of the membership will be participating in direct dues collection in the 1957-58 fiscal year and we expect that all will participate the following year.

Office Procedures

The punched card system for our membership records which we adopted a year ago has been more successful than not. We encountered unlooked for difficulties in transmitting information between our office and the service organization who maintains our records, and between the service organization and our sections and divisions. We also encountered higher costs than we anticipated. Some of the problems were of our own making, and some were thrust upon us. After a year of experience we are able to report the excessive costs are coming out of the operation by some procedural alterations on our part plus an increased utilization of our existing addressograph equipment. Annoying communication errors are a particularly knotty problem to which we intend to apply some of our best probability thinking. In a year we have come a long way. Next year we must make equally long strides towards simplicity, economy and accuracy in these procedures.

Milwaukee, Wis.
June 30, 1957

L. S. EICHELBERGER, Executive Secretary

Exhibit A—Record of Membership Growth

Date	Members	% Renewals	Net Gain	% Gain	New Members	Active Sections	Members Rec'd. for Following Fiscal Year
June 30, 1947	1926				1926	25	*
June 30, 1948	2102	*	176	9	*	31	*
June 30, 1949	2638	75.2	536	25	1058	35	*
June 30, 1950	3510	76.7	872	33	1489	42	58
June 30, 1951	4245	80.5	735	21	1422	48	167
June 30, 1952	6109	81.2	1864	44	2669	60	207
June 30, 1953	7430	75.0	1321	22	2846	71	146
June 30, 1954	8548	77.5	1118	15	2798	80	254
June 30, 1955	8780	74.7	232	3	2399	86	177
June 30, 1956	9673	78.6	891	10	2781	92	184
June 30, 1957	10495	78.3	822	8	2924	97	174

*No Record

Exhibit B—Membership Report 1956-57

	Membership June 30, 1956		Membership June 30, 1957		
District 1	Total	Fellows	Sr. Members	Members	Total
Boston	187	6	34	169	209
Burlington	24		6	9	15
Buzzards Bay	50		2	38	40
Hartford	134	1	27	109	137
New Hampshire	22		7	16	23
New Haven	78	2	25	55	82
Pittsfield	59		1	54	55

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St. Petersburg Beach 6, Fla.

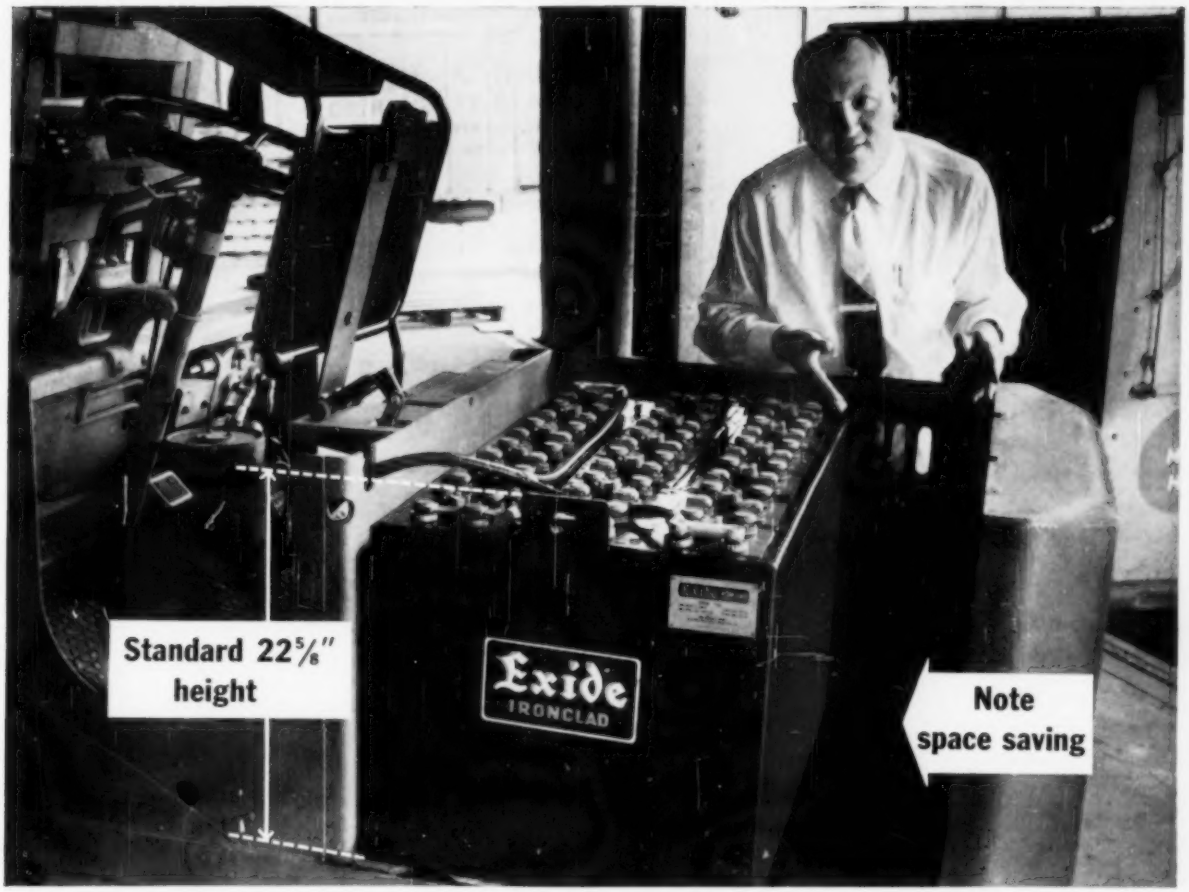
Good News

It is a pleasure to report that Professor Edwin G. Olds is recovering rapidly from a threatening illness incurred in June and expects to be able to resume his usual activities in the fall. Ed is very grateful to his friends for the many communications which they have sent him. He wishes it were possible to thank each individual personally. As a matter of some slight statistical interest, he reports that the large sample of "pep-up" cards thus far received contain only one pair of duplicates.

An Early Inspection System Using A Demerits-Per-Unit Basis

You must know that there is a tribe of Tartars called Kungurat, who are noted for their beauty. The great Khan sends his commissioners to the province to select four or five hundred, or whatever number may be ordered, of the most beautiful young women, according to the scale of beauty enjoined upon them. And they set a value upon the comparative beauty of the damsels in this way. The commissioners on arriving assemble all the girls of the province, in presence of appraisers appointed for the purpose. These carefully survey the points of each girl in succession, as for example, her hair, her complexion, eyebrows, mouth, lips, and the proportion of all her limbs. They will then set down some as estimated at sixteen points, some at seventeen, eighteen, twenty, or more or less, according to the sum of the beauties or defects of each. And whatever standard the great Khan may have fixed for those that are to be brought to him, whether it be twenty points or twenty-one, the commissioners select the required number from those who have attained that standard, and bring them to him.

Travels of Marco Polo, Universal Library Edition, Book II, Chapter VIII, Page 107, (written about 1260)



Greater flexibility. A 5000 lb. capacity truck with a 648 amp-hr new TG Exide-Ironclad battery. Same truck could hold a 936 amp-hr battery for increased work capacity if needed. Or the 648 amp-hr battery could also be used on a truck as small as 2000 lb. capacity. This flexibility is possible only with Exide's exclusive new TG battery.

NEW TG EXIDE-IRONCLAD BATTERY PACKS SAME POWER IN SMALLER SIZE FOR LOWER COST

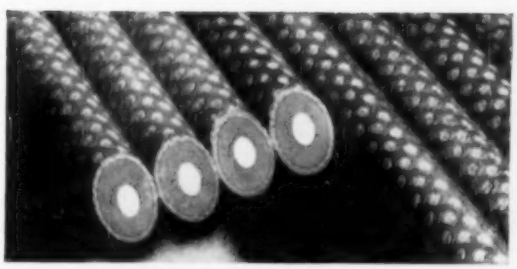
Improved design gives more power and life per dollar. Superior peak-load performance.

Here's the kind of battery economy that really counts: more power and life per dollar. The TG Exide-Ironclad is the most advanced and economical battery ever built for electric industrial trucks.

Every plate packs more power; fewer plates are required to perform a given duty cycle. That means you get a more compact battery with the *standard 22⅝ in. height*. It also means that, for a given capacity, the new TG costs you less. TG's armored porous tubing prevents practically any loss of active material; so even greater economy is gained as a result of its long, dependable service life.

More work from your trucks. The compactness of the TG means you can install more power in your trucks—thus, get more work from them. For a given size truck, TG can give you up to 44% more power than batteries you might otherwise use.

Only Exide offers you so much. When you order new batteries, get all the power, performance and life your dollar can buy. Get TG EXIDE-IRONCLAD. For full particulars about the extra productivity and longer life of the new battery, call your EXIDE Sales Engineer, or write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 2, Pa.



New, more porous armored tubing for positive plate. Eases current flow. Holds more active material. Boosts battery power. Corrosion resistant Silvium* grid insures long plate life.

*Exide's patented grid alloy

Exide®

THE ELECTRIC STORAGE BATTERY COMPANY

	Membership June 30, 1956		Membership June 30, 1957		
	Total	Fellows	Sr. Members	Members	Total
Rhode Island	100	3	11	53	67
Southern Connecticut	144	2	29	119	150
Western Massachusetts	70	4	20	48	72
Worcester	70	2	7	66	75
Total	938	20	169	736	925
District 2					
Albany	89	5	18	56	79
Binghamton	91		13	77	90
Buffalo	87	2	23	68	93
Corning-Elmira	108		13	126	139
Mid-Hudson	93		13	96	109
Rochester	135	10	69	54	133
Syracuse	107	2	28	74	104
Utica	34		6	25	31
Total	744	19	183	576	778
District 3					
Metropolitan	633	28	147	588	763
District 4					
Hamilton	45	4	3	45	52
Montreal	97	3	9	112	124
St. Catharines	27		1	29	30
Toronto	98	1	20	96	117
Western Ontario	43		7	50	57
Windsor	53		8	35	43
Total	363	8	48	367	423
District 5					
Allentown-Bethlehem	85	1	8	93	102
Danville-Sundury	41		3	26	29
Erie	37		4	42	46
Harrisburg	71		12	130	142
Lansdale	55	2	10	38	50
Philadelphia	249	5	77	196	278
Pittsburgh	112	6	35	92	133
Scranton-Wilkes-B.	65		10	51	61
Trenton	33		7	31	38
Total	748	14	166	699	879
District 6					
Baltimore	125	4	15	102	121
(Carolinas)	58		11	25	36
Cumberland	32		1	33	34
Delaware	76	3	10	69	82
Richmond, Va.	42	1	12	35	48
Washington	112	6	24	91	121
Total	446	14	73	355	442
District 7					
Cleveland	337	10	87	244	341
District 8					
Charleston				65	65
Cincinnati	173	3	15	189	207
Columbus	111	1	14	112	127
Dayton	130	4	15	101	120
Hamilton-Middletown			1	58	59
Lima			1	46	47
Parkersburg	41		1	61	62
Toledo	92	1	8	82	91
Youngstown	60	1	3	66	70
Total	607	10	58	780	848
District 9					
Evansville-Owen.	31		4	32	36
Grand Rapids	34	1	5	20	26
Greater Muskegon	32		9	35	44
Indianapolis	288	5	42	228	275
Muncie	42	1	7	25	33
N. E. Indiana	59	2	10	46	58
So. Bend-Mishawaka	125		13	117	130
Richmond, Ind.			4	43	47
Total	611	9	94	546	649
District 10					
Michigan	445	10	88	372	470

	Membership June 30, 1956		Membership June 30, 1957		
	Total	Fellows	Sr. Members	Members	Total
District 11					
Chicago	643	14	116	483	613
District 12					
Central Ill.	51	2	21	17	40
Iowa	179	7	45	99	151
Kankakee-Joliet			4	38	42
Milwaukee	215	2	52	166	220
Minnesota	185	1	24	177	202
Racine	47		16	29	45
Rockford	42	2	10	39	51
Winnebago	43	1	7	39	47
Total	762	15	179	604	798
District 13					
Denver	54	1	6	41	48
Kansas City	81		16	79	95
Lincoln	43	1	8	39	48
St. Louis	159	7	50	124	181
Wichita	188		17	170	187
Total	525	9	97	453	559
District 14					
Albuquerque	77	1	10	97	108
Baton Rouge—N. O.	52		2	42	44
Dallas-Ft. Worth	169	1	27	170	198
Mexico City	44			50	50
San Antonio	32		4	26	30
South Texas	74	2	12	81	95
Waco	39		4	37	41
Total	487	4	59	503	566
District 15					
Birmingham	62		3	41	44
Chattanooga	39		4	27	31
Georgia	59	2	15	34	51
Huntsville	16		3	22	25
Louisville	76		10	78	88
Memphis	28		12	24	36
Tennessee	38	1	16	22	39
Total	318	3	63	248	314
District 16					
Japan	74		14	61	75
Los Angeles	335	8	100	282	390
Phoenix			16	34	50
Portland	39		3	43	46
Salt Lake City	21	1		17	18
San Bernardino	88		15	57	72
San Diego	110		50	75	125
San Francisco	127	2	31	144	177
Seattle	73	2	14	64	80
Tucson	36		3	16	19
Total	903	13	246	793	1052
International		1	8	66	75
Members-in-training					93
GRAND TOTALS	9673	201	1881	8413	10495

Appendix B: Report of the Treasurer

During the 1956-57 fiscal year, the Society has made significant advancement in the establishment of improved accounting and budgetary controls. All of the Society's financial accounting activities have been centralized in the Milwaukee office. This has resulted in much improvement in securing early and accurate posting of all income and expense items.

The consulting services of the auditing firm of Ernst and Ernst were utilized in setting up the accounting practices in the National Office. Additional refinements and improved budget reporting techniques are being placed in effect.

The annual financial report format has been revised in accordance with the recommendations of the Auditing Committee. It will now be more meaningful, and more easily understood.

All matters relating to insurance and bonding for the Society employees and activities have been centralized in the National Office under the supervision of the Administrative Secretary.

THE NEW DERMITRON

NON-DESTRUCTIVE COATING THICKNESS TESTER

- For Metals on Metals
- Non-Conductors on Metals
- Metals on Non-Conductors

WRITE FOR FULL INFORMATION

UPA

FAST
ACCURATE
PORTABLE
COMPACT
DIRECT-READING

UNIT PROCESS ASSEMBLIES, INC.
61 East Fourth Street • New York 3, N. Y.

Clarification of division financial responsibility has been accomplished and a standard form for the reporting of division financial status on a quarterly basis has been instigated.

The Society's Auditing Committee is accomplishing a review of, and will provide recommendations for certain changes in the auditing and reporting of convention accounts.

The committees reporting to the Treasurer have been active during this fiscal year. Following is a brief review of their more important accomplishments:

1. A system has been established in conjunction with the National Office for the quarterly reporting of budget conformance in all areas of income and expense. These budget reports are being maintained on a current basis, and have been very useful to the officers of the Society.
2. The Financial Advisory Committee has accomplished the administration of the Society's securities and investments in accordance with the governing principles laid down by the Executive Committee. The final audit report covering their activities is published in this issue of *Industrial Quality Control*.

A complete statement of the Society's financial status, as reported by the Auditing firm of Ernst and Ernst, is published in this issue of *Industrial Quality Control*.

Fort Worth, Texas
June 30, 1957

J. Y. McCLURE, Treasurer

Exhibit C—Balance Sheet as of June 30, 1957 (Cash Basis)

GENERAL FUND

ASSETS			LIABILITIES, RESERVES, AND BALANCES	
Cash:				
Demand deposit	$19,755.22			
Time deposit	940.44			
For deposit	4,268.00		Pay roll taxes and taxes withheld from employees	$ 772.47
Petty cash funds	590.00	$25,553.66	Due to sections	145.00
			Due to divisions	68.00
Inventories—at nominal amounts:			Dues collected in advance	19,598.00
Back Issues of *Industrial Quality Control* conference papers and other technical literature	$ 1.00			
Stationery and supplies	1.00	2.00		
Office furniture and equipment—at nominal amount		1.00	Fund balance	4,973.19
		$25,556.66		$25,556.66

SECURITIES FUND

Cash—demand deposit		$ 1,312.00	Reserve for possible losses on securities	$ 5,000.00
Marketable securities—at cost:				
United States Treasury bonds (quoted market $21,849.37)	$23,350.48			
Other marketable securities (quoted market $70,695.64)	65,956.40	89,306.88	Fund balance	85,618.88
		$90,618.88		$90,618.88

CONVENTION FUND

Cash—demand deposit		$11,997.08	Reserve for future conventions	$ 3,500.00
			Fund balance	8,497.08
		$11,997.08		$11,997.08

BRUMBAUGH AWARD FUND

Cash—time deposit		$ 2,178.89	Fund balance	$ 2,178.89

SHEWHART MEDAL FUND

Cash—time deposit		$ 864.54	Fund balance	$ 864.54

SADDORIS AWARD FUND

Cash—time deposit		$ 30.14	Fund balance	$ 30.14

NOTE A—As of July 1, 1956, the Society changed from an accrual basis to a cash basis of accounting. The effect of this change was to increase the fund balance of the General Fund by $20,354.33 (excess of accrued payables over receivables) at July 1, 1956, and to charge operations with a corresponding amount for the current year. At June 30, 1957, accounts receivable from advertising magazine reprints, etc. amounted to $2,762.95, and accounts payable for printing and other purchases amounted to $5,515.22.

Exhibit D—Changes in Fund Balances for Year Ended June 30, 1957

	General Fund	Securities Fund	Convention Fund	Brumbaugh Award Fund	Shewhart Medal Fund	Saddoris Award Fund
Balance at July 1, 1956	$ 2,175.54	$81,262.34	$ 1,410.28	$2,161.26	$ 878.79	$ 46.57
Add adjustment to reflect change to cash basis of accounting—Note A	20,354.33					
ADJUSTED BALANCE AT JULY 1, 1956	$22,529.87	$81,262.34	$ 1,410.28	$2,161.26	$ 878.79	$ 46.57
Add:						
Contribution from Convention Fund	$ 6,000.00					
Excess of income over expense (Deficiency)	(23,556.68)	$ 4,356.54	$16,586.80	$ 17.63	($ 14.25)	($ 16.43)
	($17,556.68)	$ 4,356.54	$16,586.80	$ 17.63	(14.25)	($ 16.43)
	$ 4,973.19	$85,618.88	$17,997.08	$2,178.89	$ 864.54	$ 30.14
Deduct:						
Contribution to General Fund			$ 6,000.00			
Transferred to reserve for future conventions			$ 3,500.00			
			$ 9,500.00			
BALANCE AT JUNE 30, 1957	$ 4,973.19	$85,618.88	$ 8,497.08	$2,178.89	$ 864.54	$ 30.14

See note to balance sheet.

Exhibit E—Statement of Income and Expenses, Year Ended June 30, 1957

GENERAL FUND

Income			Sales of back issues	2,005.36
Membership dues:			Sales of reprints	1,147.86
Members in Training	$ 256.50		Sale of technical literature	5,909.25
Regular members	47,634.00			
Senior members	14,775.00		Miscellaneous:	
Fellows	1,490.00		Reimbursement by sections for stationery, supplies, and services	$ 1,194.97
	$64,155.50		Reimbursement by sections for insurance	140.00
Less refunds, etc.	63.94	$ 64,091.56	Sale of society pins, certificates, etc.	903.79
			Interest received on bank deposits	28.70
Publications:			Sustaining contribution	766.00
Advertising	$36,433.04		Other	464.14
Library subscriptions	12,112.60			
			TOTAL INCOME	

Expenses		
Publications:		
Printing costs—magazine	$44,771.37	
Engraving costs	1,906.49	
Cost of authors' reprints	1,702.89	
Printing costs—back issues	1,785.35	
Printing costs—technical literature	2,893.80	
Mailing expense—magazine	3,774.43	
Salaries	14,556.15	
Advertising:		
Commissions and discounts	4,519.77	
Promotion	400.81	
Contract commissions	2,132.43	
Office supplies and expense	1,397.27	
Travel expense	1,138.08	
Postage	63.13	$ 81,041.97
Committees and sections:		
Travel expense	$ 211.94	
Office supplies and expenses	53.94	
Postage	13.85	
Printing and mimeographing	16.90	296.63
Executive group:		
President's office supplies and expense	$ 180.39	
Vice President's office supplies and expense	130.04	
President's special fund	347.18	
Executive committee expense	317.04	974.65
Executive secretary:		
Salaries	$29,441.11	
Printing and mimeographing	4,480.56	
Postage	2,877.33	
Office supplies and expense	1,239.34	
Rent	3,911.00	
Traveling expense	2,094.61	
Cost of IBM deck	4,570.12	
IBM records maintenance	8,794.42	
Telephone and telegraph	1,308.47	
Services to sections and divisions	1,938.15	
Office equipment	1,328.45	
Mailing supplies and expense	194.44	
Certificates and pins	615.49	
Equipment maintenance	153.19	62,946.68
Treasurer:		
Insurance	$ 1,347.55	
Legal and other professional	942.24	
Pay roll taxes	801.71	
Blue Cross insurance	296.99	
Office supplies and expense	29.21	
Collection and Exchange	68.82	
Postage	7.50	3,494.02
TOTAL EXPENSES		$148,753.95
EXCESS OF EXPENSES OVER INCOME		$ 23,556.68

See note to balance sheet.

SECURITIES FUND

Income		
Dividends received	$ 1,892.16	
Interest received	1,407.87	$3,300.03
Gain on sales of securities		1,519.25
TOTAL INCOME		$4,819.28
Expenses		
Bank charges for administration		462.74
EXCESS OF INCOME OVER EXPENSES		$4,356.54

See note to balance sheet.

CONVENTION FUND

Income		
Technical registration fees	$28,113.98	
Less cancellations	667.50	$27,446.48
Exhibits booth sales		23,032.50
Transactions sales		4,357.20
Social program		1,212.00
Ladies' program		645.00
Plant tours		536.00
Exchange fees, etc.		78.42
TOTAL INCOME		$57,307.60
Expenses		
Luncheons and banquets		$13,987.65
Exhibits		6,503.79
Technical program:		
Services and labor	$ 1,830.60	
Equipment and furniture rental	1,502.25	
Program and speakers	765.71	
Registration expense	612.05	
Special events	479.41	5,190.02
Transactions		4,982.33
Publicity:		
Printing	$ 1,822.26	
Mailing costs	1,103.47	
Postage	913.84	
Publicity and promotion	339.43	
Freight and express	83.94	4,262.94
General administrative:		
General expense	$ 2,378.51	
General chairman	167.05	
Host group expense	137.16	
Transactions chairman	26.81	
Banking charges	6.16	2,715.69
Social program:		
Reception—social evening	$ 1,393.01	
Ladies' program	870.60	
Entertainment	100.00	2,363.61
Booth expense:		
A. S. Q. C. booth	$ 262.02	
Book booth	285.25	547.27
Properties		167.50
TOTAL EXPENSES		$40,720.80
EXCESS OF INCOME OVER EXPENSES		$16,586.80

See note to balance sheet.

BRUMBAUGH AWARD FUND

Income	
Contributions by Metropolitan Section	$100.00
Interest on bank deposit	67.63
TOTAL INCOME	$167.63
Expenses	
Cash award to Besse Day	$ 50.00
Cash award to Francis Del Priore	50.00
Cash award to Edward Sax	50.00
TOTAL EXPENSES	$150.00
EXCESS OF INCOME OVER EXPENSES	$ 17.63

SHEWHART MEDAL FUND

Income	
Contributions by Metropolitan Section	$100.00
Interest on bank deposit	28.93
TOTAL INCOME	$128.93
Expenses	
Cost of medals, engraving, and lettering	143.18
EXCESS OF EXPENSES OVER INCOME	$ 14.25

SADDORIS AWARD FUND

Income	
Interest on bank deposit	$ 1.57
Expenses	
Cost of certificates	18.00
EXCESS OF EXPENSES OVER INCOME	$ 16.43

See note to balance sheet.

Certificate of Audit

We have examined the statement of assets and liabilities (cash basis) of the American Society for Quality Control, Inc. as of June 30, 1957, and the related statements of revenues and expenses and changes in fund balances for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the accompanying statements which are above referred to present fairly the assets and liabilities arising from cash transactions at June 30, 1957, and the income and expenses and changes in fund balances relating to such transactions for the year then ended.

Milwaukee, Wisconsin,
July 22, 1957.

Ernst & Ernst
Certified Public Accountants

Appendix C: Report of the Editorial Board

Purpose of the Board

It is the function of the Editorial Board to have operating supervision of *Industrial Quality Control* and all other technical publications of the Society.

Advertising

A review of the advertising support for Volume XIII will be found in the report of Leon Bass, Vice President.

Data on Volume XIII

This volume consisted of 568 pages plus 48 cover pages. Of the 568 pages available for editorial copy, 421, or about 74 per cent were used for this purpose, the remaining 26 per cent were used for paid ads and miscellaneous items. Of the 48 cover pages, 32 were for paid ads, 12 for front covers, and 4 for ASQC publicity.

Issue No. 6 (December 1956) was earmarked as the Administrative Applications Division issue. However, only 3 of the 5 papers accepted for this issue could be accommodated in it; one of the other two appeared in the January 1957 issue, and the other in the March issue.

In these twelve issues a total of 42 contributed papers were published, averaging 4.5 pages per paper and ranging from a little under one page to 16 1/3 pages in length. Percentagewise, these 568 pages were distributed as follows:

Contributed papers	33.3%
Local Section News	14.3%
Departmental Copy	11.6%
Paid ads	25.2%
Miscellaneous (Masthead and Contents pages, editorials, ASQC Convention Publicity, Stock Lists, Annual Reports, Index to Vol. XIII, etc.)	15.6%
	100%

Contributed papers can be classified as follows:

General applications of SQC Methods	10
Special applications of SQC Methods	
Administrative Applications	4
Sampling	4
Linear Programming	1
General Interest	11
Technical	12

Reprints

During Volume XIII, 31 contributor's orders for reprints on a shared cost basis were processed; quantities ordered ranged from a modal value of 100 up to one order for 1,000 and one for 1,500 copies. Non-contributor requests for permission to reprint items from IQC and other publications on which ASQC holds copyright totalled 73 in the period July 1, 1956—June 30, 1957. Two of these requests were rejected; 71 approved.

General Publications

In September 1956, the Society published a 60-page booklet on "The Span Plan" by Leonard A. Seder and David Cowan, approved by the Editorial Board for issuance as General Publication No. 3.

New Department Added

The newest member of the departmental family is the Supervisor's Circle department. This new department was activated for the first time in our No. 4, October 1956 issue in which the objectives of the department were outlined and an editorial note provided to acquaint our readers with the origins and expectations of this department.

Editorial Board

The following men have accepted appointment to the Editorial Board for a five-year term beginning July 1, 1957:

Cecil C. Craig, University of Michigan
A. V. Feigenbaum, General Electric Co.
Enoch B. Ferrell, Bell Telephone Laboratories, Inc.

The three men retiring from the Board as of June 30, 1957 are:

Paul C. Clifford, Montclair State Teachers College
Leonard A. Seder, Consultant
W. J. Youden, National Bureau of Standards

Acknowledgment

Grateful acknowledgement is due the following persons for editorial assistance in reviewing submitted manuscripts in cooperation with the Editorial Board:

Irving W. Burr	Gayle W. McElrath
Cecil C. Craig	Carl E. Noble
Harold F. Dodge	Edwin G. Olds
Enoch B. Ferrell	Ellis R. Ott
Hugo C. Hamaker	Paul A. Robert
Howard L. Jones	Harry G. Romig
Lloyd A. Knowler	Mary N. Torrey

The Editorial Board and the Society also acknowledge appreciation to the following Department Editors who are serving our journal so faithfully in the maintenance of its departmental activity:

Bibliography	Joe Movshin
Book Review	W. D. Baten
Local Section News	G. R. Foster
Management's Corner	J. M. Juran
Practical Aids	E. R. Ott
Problems Department	P. C. Clifford and T. A. Budne
Supervisor's Circle	P. A. Robert
What's New?	R. A. Wylie

For the Editorial Board
Mason E. Wescott
Chairman

What's New?

ROY A. WYLIE, *Editor*

When inquiring about "What's New?" items, please mention INDUSTRIAL QUALITY CONTROL

The Allegany Instrument Co., Inc., 1091 Wills Mountain, Cumberland, Md. and 1052 West 6th St., Los Angeles 17, Calif. has announced a new Electronic instrument for time integral measurements of dynamic phenomena in research and quality control. In the study of transient and dynamic phenomena, investigators obtain an analog record which is measured to find such values as action time, rise time, magnitudes at various times during the test, etc. In many cases, these investigators also measure the *area beneath* the analog curves, or *integral*, which they then convert to impulse, energy, velocity, displacement, power, total illumination, heat transfer, average stress, etc., depending upon what variable the analog curve represents. Manual measurement, electromechanical and electronic devices have been used to obtain these integrals. The ALINCO Model 270 integrating system is an all-electronic instrument for investigators who wish to obtain the time integral of rapidly varying, short or long term analog signals. It is supplied as a portable or rack-mounted instrument, and gives its user accurate digital display of both the integral and the action time of the phenomenon being measured. Output connectors are provided so that this information can be automatically printed by a typewriter or fed onto tape. The Model 270 has a counting rate of 10,000 counts per second which permits the investigators to measure values over time intervals as short as 10 milliseconds.

★ ★ ★

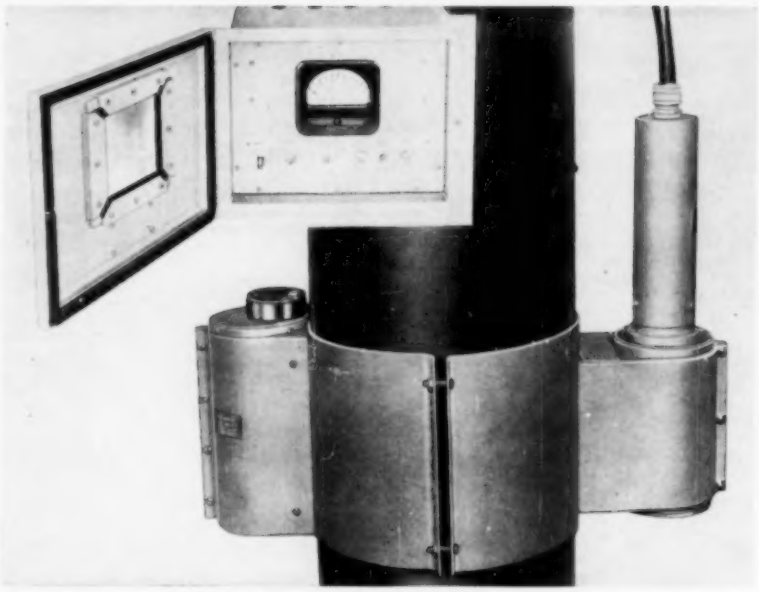
Problems of analyzing extremely small amounts of gaseous mixtures, or liquids capable of being vaporized, can now be solved with a new, inexpensive, portable mass spectrometer designed for both laboratory and industrial use. The Type 21-611 Mass Spectrometer is being introduced by **Consolidated Electrodynamics Corp.**, Pasadena, Calif. The instrument was developed to provide an accurate but inexpensive, small-size model for medical, industrial, and university applications. This unit is of rugged, modular construction and features unusual portability. It permits engineers and research scientists to perform precise batch or process analysis in the field or in the plant. The over-all mass range of the instrument is from 2 to 80 with resolving power adequate for separation of adjacent peaks up to about mass 35. The new spectrometer possesses an improved scanning feature. Mass numbers appear linearly with time on a large, motor-driven dial, making mass marking unnecessary. A manual override on the motor drive permits the operator to turn quickly to any mass number of interest, or to start and stop the automatic scan at any desired point. A metal rotary valve makes batch sample introduction a simple, routine operation and eliminates the complicated procedures commonly employed. Its high sensitivity makes possible the detection of gas impurities in the low ppm range. Utilization of new, but proven, concepts in vacuum technology permitted the elimination of traps and separate pumping units for the inlet system. New electronic circuits permit simple controls and a reduced number of tubes and the need for a magnet shunt for focusing the low-mass ions has also been circumvented. The mass spectrometer weighs only 115 pounds and is suitable for bench, rack, or trailer mounting, with the analyzer and control modules either stacked or separated.

★ ★ ★

The development of a new test jig, designed for precision testing of magnetic tape wound bobbin cores, has been announced by the Electronic Instruments Division of the **Burroughs Corp.**, 1209 Vine Street, Philadelphia 7, Pa. The jig provides

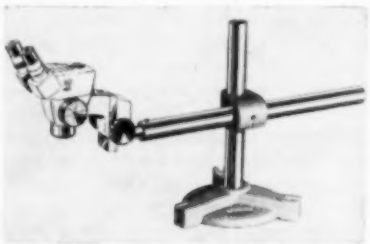
a means of applying either positive or negative current driving pulses to the core being tested and incorporates circuits permitting direct viewing on an oscilloscope of the current pulse at the point of application to the core and also the output pulse induced by the switching of the core. The jig is available in two models, Types 8040 and 8041, the difference between models being the size of bobbin flange each will accommodate. In operation the two models are identical. The core is inserted into the jig by placing it between two pairs of sensing pins. When the cover arm is pulled down, the two pins in each pair are connected, thus forming a tight, single-turn winding on each side of the core—one for the input, the other for the output. In both models the pin spacing is adjustable in order to assure a tight loop around the core for different size bobbins. The test jigs have been designed as part of Burroughs Core Tester BCT 301, a complete system for individually testing tape wound cores.

★ ★ ★



The Ohmart Corp., 2236 Bogen Street, Cincinnati 14, Ohio has introduced a standardized radioactivity density gauge, called the Model LSG, which is based on the principles utilized in their custom gauge installations. The new instrument is designed to measure or control process variables by measuring the density, specific gravity, or percent solids of the process material. When installed on a 10 inch diameter pipe, span of 0.2 and precision of ± 0.004 are realized. The instrument may be used on larger pipes or smaller pipes down to 3 inch diameter, and may also be used to indicate interface arrival in pipeline applications. Because all measuring components of the instrument are located external to the vessel carrying the process material, operation is not adversely affected by conditions of high or low temperature, pressure, viscosity, corrosion or abrasion.

★ ★ ★



A new, low-priced table stand for horizontal and vertical positioning of American Optical Series 55 CYCLOPTIC Stereoscopic Microscope has just been announced by the **American Optical Co., Instrument Division**, Buffalo 15, N. Y. The new Economy Table Stand, Model 22, has a wide range of adjustments—a full 360 degree swing around a vertical pillar over a four foot circle—a 20 inch horizontal and a 15 inch vertical excursion. The heavy-weight base is notched to allow quick at-

NOMINATIONS FOR THE 1956-1957 BRUMBAUGH AWARD

In accordance with the provisions governing the Brumbaugh Award, nominations by individual members of ASQC are requested in order to assist the Brumbaugh Award Committee in making its selection. Below is a ballot for your use. Please fill in the ballot and *mail it now*.

In making your selection, please keep in mind that you are to choose the article published in *Industrial Quality Control* that you judge to have made the greatest contribution to the development of industrial applications of Quality Control.

Send your ballot to Cuyler J. Hawkes, Eastman Kodak Company, Camera Works, Rochester 4, New York. All Ballots received up to Nov. 1, 1957 will be accepted.

I recommend that the article written by

.....

and published in the ..... issue

of IQC under the title of .....

.....

be awarded the 1956-1957 Brumbaugh Award.

.....
(signed)

The articles which are eligible for this year's award are those that appeared in Volume XIII—July 1956-June 1957.

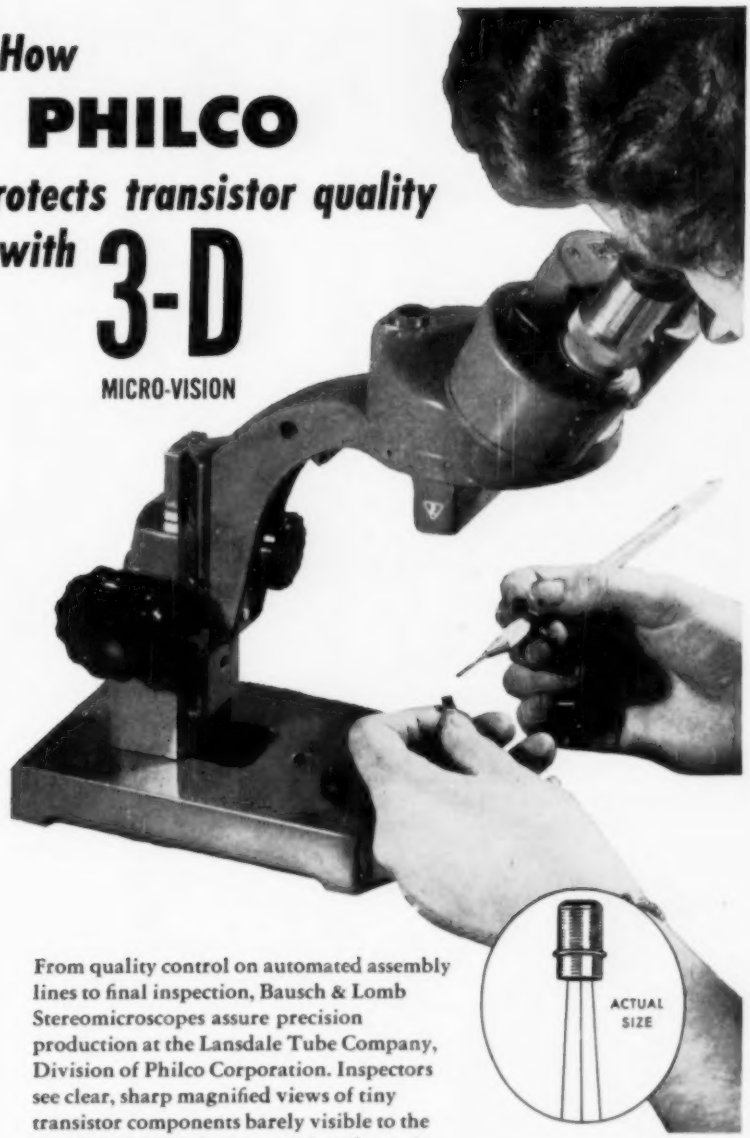
tachment to work table when a relatively permanent set-up is required.

★ ★ ★

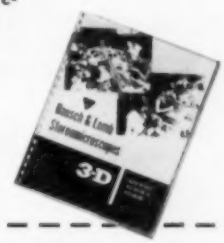
Steel City Testing Machines, Inc., 8817 Lyndon Avenue, Detroit 38, Mich., has designed a new compact, portable, hydraulically operated machine for quick accurate compression testing. Originally designed to meet the requirements of the U.S. Air Force, this unit combines simple hand pump operation with ease of adjustment in vertical dimension, and a capacity of 150,000 pounds. The overall weight of the Model TP-121 tester is approximately 170

pounds, and it can be handled by two men. Convenient carrying handles are provided to aid in moving the instrument. The hand pump folds into a vertical position to make the tester more compact for carrying purposes. The press, however, is equally suitable for stationary use in a laboratory for conventional compression testing purposes. The position of the upper head can be changed easily for any vertical dimension between 9½ and 32 inches, and width between uprights is 11 inches. The upper anvil is spherically seated to assure perfect alignment during testing operations. The compressive force is provided by means of a hand operated pump which incorporates its own oil reservoir. A piston stroke of 1½ inches is standard on this unit. The tester was originally designed for use in calibration of proving rings and other

How **PHILCO** protects transistor quality with **3-D** MICRO-VISION



From quality control on automated assembly lines to final inspection, Bausch & Lomb Stereomicroscopes assure precision production at the Lansdale Tube Company, Division of Philco Corporation. Inspectors see clear, sharp magnified views of tiny transistor components barely visible to the unaided eye. Work is seen right-side-up, in natural 3-dimensional relief. Freedom from eyestrain and discomfort increases efficiency. The result: precision standards that assure distortion-free sound in Philco-equipped transistor radios . . . speed and reliability in Philco-equipped computers.



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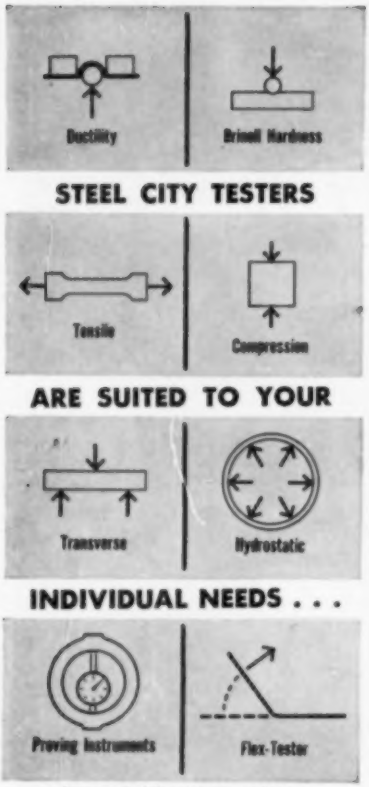

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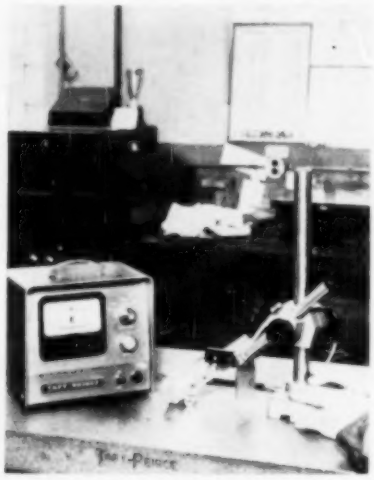
load measuring devices, where a load gauge was not required. For normal compression testing purposes a suitable gauge is available mounted to the rear of the pump. The illustration shows the machine without a gauge being used in the calibration of a proving ring.

★ ★ ★

A new type of electronic gage called the Versachek has been announced by the Instrument Gage Division of the **Taft-Peirce Manufacturing Co.**, Woonsocket, R. I. The Versachek



converts minute differences in established dimensions into voltage changes and amplifies them for reading on a meter scale by means of electronic circuitry. A basic Versachek unit consists of an electronic amplifier and pickup head, mounted on either a height gage stand or comparator stand. Gaging is accomplished by setting the Versachek gage head to a specific dimension by means of gage blocks or other suitable master and comparing actual product dimensions, reading the variance from the master on the meter scale. There are four magnifications available on the standard unit: 400:1, 2000:1, 4000:1, and 20,000:1. These can be quickly selected by a switch on the front panel. Other magnifications can be furnished for special applications. The Versachek uses self-calibrating circuit which eliminates the need for constant reference to gage blocks. Special pilot lights on the meter indicate the scale in use; and the completely portable unit can be adapted to other devices, such as ink recorders, oscilloscopes, and digital voltmeters. The Versachek is housed in an aluminum cabinet, 9¼ inches wide × 7¾ inches deep × 8½ inches high and the weight is 13 pounds.

★ ★ ★

A new line of lightweight Magnesium and Aluminum Inspection equipment has been announced by **The Challenge Machinery Co.**, Grand Haven, Mich. The new equipment, which is one-fourth to two-fifths the weight of standard semi-steel equipment, offers many advantages where larger sizes are being used. Much physical effort is eliminated and frequently, the need for an extra man or a power hoist in moving the equipment. Magnesium and Aluminum Universal Angle

Aircraft Division News

The annual meeting was held at the Annual Society Convention, Detroit, May 22. After the business meeting, the teller's committee reported the following officers elected for 1957-58.

Chairman, Ralph Humphries, Cessna Aircraft Co., Wichita, Kans.
Vice Chairman: H. Earle Moore, McDonnell Aircraft Corp., St. Louis, Mo.
Secretary: Paul Allen, Beech Aircraft, Wichita, Kans.
Treasurer: W. A. MacCrehan, Bendix Radio Div., Baltimore, Md.

In addition to the above listed officers, the following were elected as district councilors: C. V. Kropp (1), D. C. Miner, Jr. (2), G. P. Putnam (3), J. J. Fitzsimons (4), T. G. Gregory (5), Max Astrachan (8), K. C. Brown (9), H. Gladding (11), O. M. Rye (12), M. P. Eaton (13), G. W. Brower (14), K. R. Willhite (16).

The new chairman has proposed the following objectives for the year which will help the division to grow:

1. Increase the membership by 25 percent.
2. Arrange for Division participation in regional and national conferences.
3. Development of Division speakers roster.
4. Increase scope of Division news coverage.
5. Continue to co-sponsor projects with the quality control committee of the Aircraft Industries Association.
6. Venture into new projects which are felt to be of prime importance to the growth and development of the Division and the Society.

Plates, Height Blocks, Pattern Makers Angle Plates, Tooling Angles, Straight Edges and Parallel Straight Edges are available in many sizes in the new lightweight line. They are available as hand scraped units accurate to within 0.0002 inches T.I.R.

★ ★ ★

A new and improved design of the "Neptel" electronic instrument which automatically measures and counts yarn neps and imperfections to control textile quality more uniformly is now in production at the **Sheffield Corp.**, Dayton 1, Ohio. The Neptel automatically inspects and indicates the number of neps and imperfections in 50 yards of yarn in 30 seconds. The yarn undergoing test passes automatically through a high-intensity, ribbon-shaped beam of light. Abrupt variations in the yarn cause comparable variations in the amount of light falling onto a photocell. The photocell converts these changes into electrical signals that pass through electronic circuits that operate counters whenever the light beam notes an imperfection. The number of imperfections in each 50 yard sample of yarn are counted and recorded at the upper right of the instrument. New automatic controls perform inspection and counting operations at speeds far greater than could previously be accomplished by visual inspections and a skilled operator is not required to operate the instrument.

★ ★ ★

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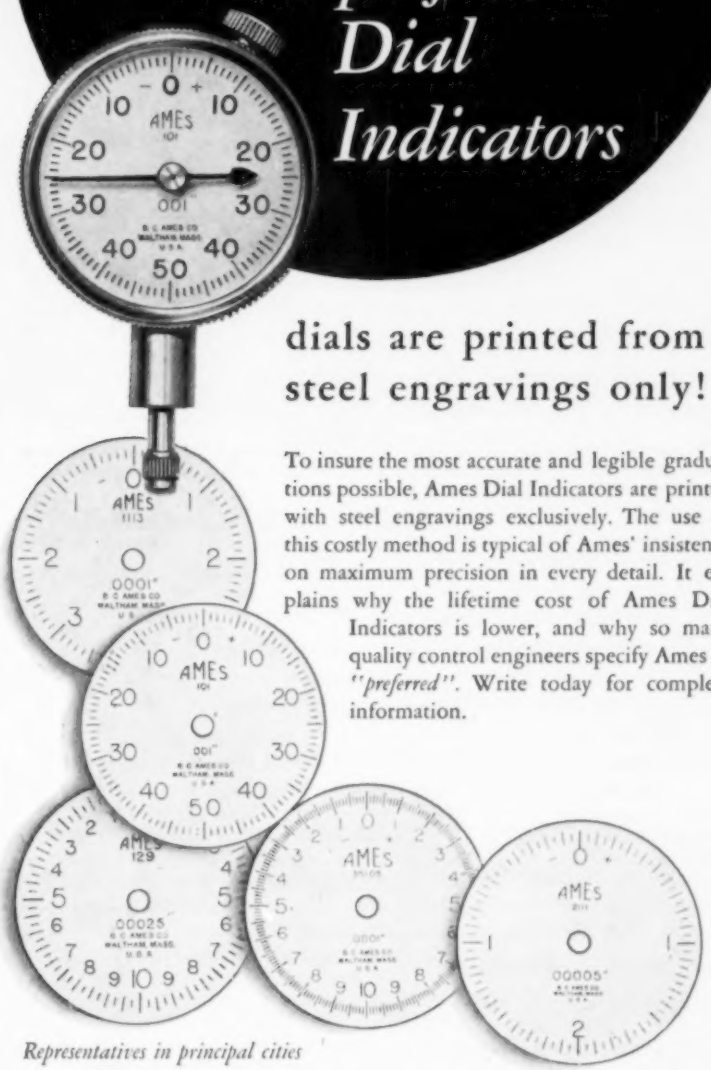

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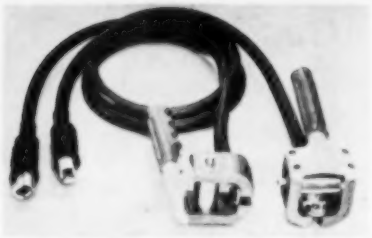

Magnaflux Corp., 7300 West Lawrence Avenue, Chicago 31, Ill., announces a new low-cost Permanent Magnet Leech to enable one man to perform Magnaflux and Magnaglo testing operations that formerly required two men. The No. 54975 Leech consists of a permanent Alnico magnet, cast steel pole pieces with an aluminum carrying handle, and 5 feet of 2/0 cable. It will remain and make electrical contact as long as desired on any magnetic surface, including vertical and overhead members. The magnetizing source may be A.C., D.C., or half-wave current, not exceeding 1500 amperes. The old method of dry powder Magnaflux testing required two men. One man positioned a prod while another applied powder and operated a second prod. The new method frees one inspector for other duties. It's easy for a single inspector to apply powder, once the Leeches (or one Leech and one prod) have been set in position. Price is $50.00 each.

★ ★ ★

Consolidated Electrodynamics Corp., 300 North Sierra Madre Villa, Pasadena, Calif., have developed Type 6-201 Primary Pressure Standard, a highly precise pneumatic deadweight tester for the convenient calibration of pressure-measuring instruments, such as other primary standards, secondary standards, and transducers. A true primary standard, the 6-201 utilizes the fundamental quantities of mass and length for its references. With its accuracy of 0.015 percent of full scale, it is applicable where the lower accuracies and range limitations of manometers and oil-type testers cannot be tolerated. Operation covers four pressure ranges from 1.5 to 50 psi, in increments of 1 percent, with a minimum pressure of 0.3 psi and includes both gage and absolute measurements. Capable of resolution better than 0.005 percent of the reading, the 6-201's stainless-steel pistons and cylinders are polished to micro-inch tolerances. The piston is rotated by an electric motor drive during measurements, and "floats" on a film of air rather than oil to minimize static friction. By a simple interchange of piston-cylinder combinations and calibrated weights, the 6-201 is made to provide a large number of discrete, high-accuracy pressure points. The pressurized gas is admitted through a port in a parallel connection with the instrument undergoing calibration. The desired pressure point is reached when the incoming pressure causes the piston and its weights to rise to a point of equilibrium and perfect balance. Pressure tables included with each instrument show the proper piston-cylinder combination and weights to be used for each pressure point. The instrument may be used directly for calibrating absolute-type transducers and pressure instruments. In this operation, the chamber within the glass bell-jar is evacuated, thus referencing the weights essentially to zero absolute pressure rather than ambient pressure.

★ ★ ★

Automatic programming and recording of qualification test results and environmental extremes are among the outstanding features of a new electronic performance and environmental testing laboratory recently placed in operation by **BJ Electronics, Borg-Warner Corp.**, 3300 Newport Boulevard, Santa Ana, Calif. The laboratory is designed to provide environment conditions for the critical operating examination of electronic and electro-mechanical devices and complete systems and incorporates the most modern environmental test equipment supported by latest instrumentation.

Chemical Division News

The First Annual Conference will be held in Philadelphia at the Benjamin Franklin Hotel on Friday and Saturday, Oct. 18-19.

The general theme of the program will be to promote workshop discussion groups. Some of the subjects which will be included in the program are: bulk sampling, analysis of variance, experimental designs, Box techniques, precision of analysis, control charts, and operations research. The application of these subjects in the chemical industry will be stressed. An outstanding list of speakers is being assembled.

QUALITY CONTROL METHODS AND MANAGEMENT

The result of the symposium held last fall at Drexel Institute of Technology and sponsored by the Philadelphia section is nine papers which comprise the "symposium transactions."

These papers present some of the quality control methods that are tools for management and also present some management views on quality control. Here are the subjects covered.

Statistical Quality Control in a Job shop
A Dynamic Quality Training Program
A Discussion of Some Simple Experimental Designs
Some Aspects of the Regression Technique
Decision Making—Facts, Fantasy and Fundamentals
Quality Improvement Campaign
Management Takes a Look at Quality Control (two papers)
Quality Control Helps Solve Inspection Problems

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Large capacity environmental test equipment is housed in a special wing at BJ Electronics. Included are devices to simulate conditions of altitude, humidity, temperature, vibration, shock, and acceleration, radio noise, rain, sunshine, salt spray, sand and dust, explosion and, where feasible, combinations thereof. Also such high performance, large capacity equipment as will provide simulated environments of altitude to 150,000 feet in two minutes, with temperatures maintained throughout the range of minus 135 degrees F., to plus 375 degrees F., 70 "g" peak vibration from 5 to 2,000 cps; and shock tests of 18,000 force pounds with any desired wave form. Automatic programming and recording of entire test phases by supporting instrumentation are provided where feasible. Four engineering and technical groups under the direction of Albert J. Baranoff, laboratory chief, are detailed to testing and evaluation projects. Testing schedules will be made available to private industry in addition to contract time already committed to government agencies.

NEW LITERATURE

A series of portable industrial x-ray equipment, which provides the highest accuracy for radiographic inspection of castings, welds, assemblies, and facilitates improvements and repairs on metal products, is illustrated and described in a 2-color, 4-page folder that has just been released by Mitchell Radiation Products Corp., 128 East Washington Street, Norristown, Pa.

Two new ultrasonic testing bulletins are available from Branson Instruments, Inc., Stamford, Conn. These application data sheets discuss the use of the Vidigage, an ultrasonic resonance instrument, for quick and accurate detection of corrosion and laminar flaws, and the measuring of metal or plastic thicknesses.

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Curtiss-Wright Ultrasonic Metal Testing Insures Quality Control

Nondestructive Test Equipment Inspects Critical Alloy Parts for Thompson Products

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The Immerscope, basic unit, detects internal flaws and presents them as visual pips on the cathode ray tube. The Dual Channel Flaw Calibrator (shown above) indicates the size of the flaw. It also provides two additional flaw alarm channels which allow a differentiation between size and type of flaw.

By console controlled manipulation, intricate shapes and surfaces may be inspected. Defects can also be recorded for immediate correction or reference.

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Here is a list of the papers contained in the 1957 Annual Convention Transactions.

- Strategy in Research
- Statistical Methods in Sorting Operations
- Statistical Studies of Rosin Sizing Evaluation Variables: IV. The Determination of Minimum-Cost Testing Procedures
- How To Use Industrial Engineering Methods Study for Quality Control
- Finding the Facts Before Setting the Specifications: II Methods
- Statistical Quality Control in Automotive Stamping Production
- Quality Control in the Manufacture of Film Coated Magnet Wire
- Quality Control in the Manufacture of Automotive Electrical Systems
- Developing Quality Standards and Ratings in Folding Paper Carton Manufacture
- Problems and Pitfalls in Acceptance Sampling of Glass Containers
- Quality Control Applied to a Job Shop
- The Design and Engineering of Test Equipment for Complex Electronic Products
- Quality Control's Obligation to Management and Customer on Reliability of Complex Weapons
- This is Inspection Automation
- A Melting Company Looks at Specifications Through Statistics
- Applications of Scheffe's Method of Paired Comparisons in Food Quality Evaluation
- The CAA Program in Quality Control
- Variability of Mechanical Properties of Flat Rolled Sheet Product
- Designing the Measurement and Analysis of Work
- Quality Control Applied to Industrial Engineering
- What is an Inspector
- Operations Research in Business and Industry
- Fractional Replication in Industrial Experimentation
- Organizing for Aircraft Quality Control
- Automotive Division First Report on Machine Tool Capability Studies
- Quality Problems of Automotive Fabrics from the Producer's Point of View
- Quality Control Training Courses: Part I, In-Plant Courses; Part II, ASQC Section Courses
- Multiple Comparisons in the Analysis of Variance
- Statistical Methods for Analyzing Performance Variations of Electronic Circuits
- Controlling the Quality of Management Decisions
- Quality Control—Its Relationship to Reliability
- An Operational Research Study on Shipping Tankage
- The Digital Computer and Its Application
- Quality Control and Production Efficiency
- Some Useful Nonparametric Significance Tests
- Initiating Quality Control and Quality Standards for New Products
- Designed Experiments in Industry
- The Team Approach in Quality Control Investigations
- Statistical Application in the Control of High Speed Filling Machines
- Semantics, Scales, and Savings Through SQC
- Quality Control From Bench to Budget
- On Some of the Necessary Ingredients of Statistical Standards of Sampling
- Managerial Statistics Applied to the Brewing Industry
- An Approach to the Vendor-Vendee Relations Program
- AQLs are Half the Story
- Sampling by Variables: I, One-Way Protection on $\bar{X}$; II, Two-Way Protection on $\bar{X}$; III, Protection on Variability; IV, Available Sampling Plans
- Quality Control in Complex Systems
- Use of Management Reports in a QC Program
- Statistical Aids to Management
- Army Quality Control and Inspection
- Contract Requirements and Quality Control
- Discovery Sampling by Attributes—Review, Revisions, and Results
- Automatic Gaging of Complex Parts by Tape Control, Etc.
- Consumer-Supplier Quality Problems and Relations
- Reporting and Analyzing Production in a Swedish Steel Plant
- Standardization and Quality Control
- Process Control in a Job-Shop
- The Proposed Military Standard for Inspection by Variables
- The Science of Quality Control as an Operation
- The Quality Manager and Quality Costs
- An Operational View of Equipment Reliability
- Quality Requirements of Automotive Fabrics
- Quality Control's Obligation to Management and Customer on Reliability
- Evaluating the Vendor
- Quality Control of Visual Characteristics
- Selection and Ranking Problems with Binomial Populations
- Quality Control in the Carton Plant
- Factors Affecting the Accuracy and Reliability of Sensory Tests
- Integration of Techniques in Process Development
- Statistics, Quality, and Control; The Essential Trio for Modern Competitive Production
- A Random Sample of Control Philosophy
- Quality Control's Obligation to Measure Terminal Quality

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A new bulletin, No. 557, on their recently developed "Golden Em-re" line of dial indicators is now available from Petz-Emery, Inc., Pleasant Valley, N. Y. The "Golden Em-re" line features extreme accuracy—1/5 of a graduation over the entire range. A 0.0001 inch indicator, for example, is accurate to within 0.00002 inches.

A reprint of the 24-page American Standard Booklet on Surface Roughness, Waviness and Lay published by the American Society of Mechanical Engineers, is now available without cost from Brush Electronics Co., 3405 Perkins Avenue, Cleveland 14, Ohio. The Standard defines geometric irregularities of solid material surfaces and physical specimens for gaging roughness. Definite classifications for roughness, waviness and lay are established, as well as a set of symbols for drawings, specifications and reports. To assure a uniform basis for measurement, specifications are also provided for precision reference specimens, roughness comparison specimens, and specifications for tracer type instruments.

Moore Products Co., H & Lycoming Streets, Philadelphia 24, Pa., have compiled a set of application bulletins on Moore air gages. Applications illustrated are: a Bearing Groove Gage; a Grinder Cascade Control; and a Grinder Control & Part Segregation instrument. Copies of these bulletins are available from the publisher.

In a new booklet on threads, Standard Pressed Steel Co., warns against the danger of accepting misfits and describes how it can be avoided. The booklet points out that two intrinsically different types of thread gages—a functional type for checking the high limit of tolerance and a pure pitch diameter type for checking the low limit of tolerance—must be used to provide a true indication of thread fit. Although the booklet discusses 3A threads, it applies equally in principle to the gaging of other classes of external thread fit. Individual copies of the booklet or quantities for distribution to interested groups can be obtained by writing to Eldred W. Scott, Advertising Department, Standard Pressed Steel Co., Box 689, Jenkentown, Pa.

A new bulletin recently issued by the Testing Machines Division of Gries Industries, Inc., New Rochelle 6, N. Y., covers methods and machines for rapid yet "standard" Brinell Hardness Tests in routine production. The bulletin also states that it is now possible to see automatically the diameters of the ball impressions (as required by the "standard" specifications of the Brinell method) on a motorized machine for rapid production Brinell testing. Heretofore motorized machines have only shown the depth of the ball impressions.

A four page catalog on their line of accurate, sensitive, easy-to-read mercurial barometers and vacuum gauges, vacuum pump gauges and absolute pressure gauges has recently been issued by Precision Thermometer & Instrument Co., 1434 Brandywine Street, Philadelphia 30, Pa.

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QUALITY CONTROL SUPERVISOR Desires permanent position in Pacific Coastal or Southwestern U.S. Extensive experience with major chemical company assisting in administration of comprehensive quality assurance program. Excellent graduate study record and complete understanding of statistical approaches to control of quality. Age 35. Detailed resume available on request. Please reply to Box 14C1 at the above address.

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Address all replies to box number references to: American Society for Quality Control, Room 6197 Plankinton Bldg., 161 W. Wisconsin Ave., Milwaukee, Wis.

SALES REPRESENTATIVE: Qualified and aggressive young men wanted as sales representatives for leading manufacturer of quality dial indicators and related gages. Process engineering, tool designing, quality control and inspection experience important. Applications considered for major Eastern and Mid-Western industrial areas. Attractive

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The overall uses of transistors are multiplying. Our products are well-accepted. Our customers are top-flight, blue chip companies to whom quality is paramount. A great percentage of our success is attributable to our strong quality control program.

To qualify, a degree in EE or Physics is required. Should have experience in electronic component quality control, or as a semi-conductor engineer.

Send resume in confidence to Personnel Director

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These advertisers provide educational information on their products, expanding the services of your journal, *Industrial Quality Control.*

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compensation and expense allowance plus future advancement is assured. For further information, please send personal resume with snapshot or photo to Standard Gage Co., Inc., Attn: Sales Manager, 70 Parker Avenue, Poughkeepsie, New York

Wanted: Statistician–B.S.–Mathematics, with experience in chemical and metallurgical operations. Set up statistical methods in manufacturing and help in the design of experiments for engineers, chemists and metallurgists. Reply, giving background information to Personal Department, Sylvania Electric Products, Inc., Tungsten and Chemical Division, Towanda, Pennsylvania.

QUALITY CONTROL SUPERVISOR

Manufacturer of converted paper products in South Western Michigan has opening for college graduate with practical quality control experience, not necessarily in the paper or converting industry. Duties will include supervision of others and development of systems for auditing quality. The immediate potential is good and future prospects for an ambitious and alert man are excellent. Educational and recreational facilities are excellent. All replies confidential. Please send resume to Box 14Q1 at the above address.

QUALITY CONTROL ENGINEER

The Erie Resistor Corp. is looking for a QC Engineer. He must be an Electrical Engineer or the equivalent who is familiar with statistical methods and life test work. The ability to correlate significant data is most essential. Will be responsible for the supervision, planning and engineering of Electrical, Mechanical and Chemical Tests for the Quality Control Laboratory of our Corporation. Our 30 year old organization is a leading manufacturer of Electronic Components, Plastics, and Electro-Mechanical devices. Send resume or request for additional information to:

Supervisor of Placement and Training
Erie Resistor Corporation
644 West 12th Street
Erie, Pennsylvania

QUALITY CONTROL MANAGER

Bucyrus-Erie Company, the leading manufacturer of excavating equipment, offers an excellent opportunity for an outstanding and resourceful individual to establish a quality control program in the area of machine shop, foundry, forge shop, and welding. This position is located in South Milwaukee, Wisconsin, and requires 10-15 years experience in quality control. Please send resume to:

E. G. Vargon
BUCYRUS-ERIE COMPANY
South Milwaukee, Wisconsin

MATHEMATICIAN—Applied Statistics to work with Operational Analysis & Control Group in attacking a variety of operational problems. Must have ability to create models which designate the system under study. The group has access to up-to-date data processing equipment, including the IBM 650 Computer. Excellent benefits and pleasant working conditions. Colleges and graduate studies available.
Please send complete resume, including education, experience, and salary requirements to:

Employment Manager
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Prompt notification of a change of address enables us to correct your records at the Headquarters Office, correct your mailing address for *Industrial Quality Control*, and notify your section to correct their mailing list. Therefore, if you move, fill out this form and mail to ASQC, 161 W. Wisconsin Ave., Milwaukee 3, Wis.

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IMPORTANT: Please do **not** use ball point or other dye-type inks. This form will be Thermofaxed and thus requires pencil, metallic-base inks or typewriters. 9-57

Lockheed Missile Systems announces

New positions in the growing science of reliability

Left to right: C. S. Bartholomew, Reliability Staff Scientist, A. L. Hubbard, Santa Cruz Test Base Manager, J. H. Yueh, Polaris Reliability Administrator, R. P. Della-Vedowa, Test Laboratories Manager, and E. C. Hart, Production Engineering Manager, discuss system reliability as a function of component reliability.

Here is a field that assumes ever-greater importance in the technology of guided missiles.

At Lockheed Missile Systems, reliability is stressed as a philosophy of operation – from research to manufacture. Increasing emphasis on reliability has created a number of new positions. Assignments are on weapon systems management programs of a most advanced nature and include:

- Establishing reliability requirements and goals on major research and development projects;
- evaluating reliability of designs;
- analyzing effects of variations in component and/or parameters on system reliability;
- designing reliability tests of parts, components and systems;
- planning flight tests for environmental data;
- evaluating specifications, drawings and test procedures;
- originating and maintaining failure reporting systems;
- analyzing failure data;
- establishing quality control standards;
- establishing environmental criteria;
- developing new approaches to reliability.

Positions are open on the Sunnyvale, Palo Alto and Van Nuys staffs. Those possessing a high level of ability and interest in this expanding field are invited to address the Research and Development Staff at Palo Alto 40, California.

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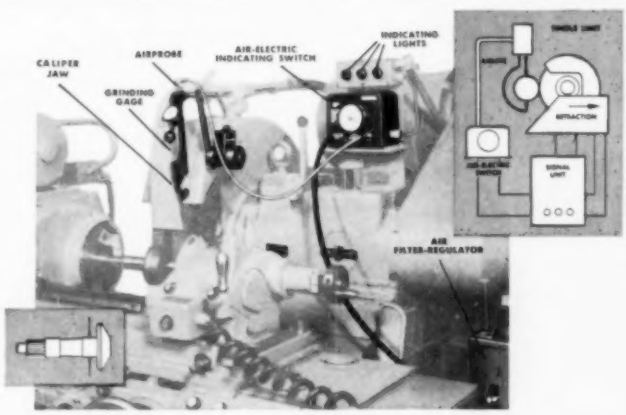
❶ AUTOMATIC CONTROL OF FINISH SIZE

This standardized control gage continuously measures and indicates size of work as it is being ground and automatically causes wheel to retract the instant finish size is reached. Unit can be easily applied in the field to any center type grinder having hydraulically controlled wheel slide.

BENEFITS: Reduces costs — one operator handles two, possibly three grinders performing the same or different operations. Gages pay for themselves within a few months.

Improves quality — even if you have only one grinder, gage is a profit-maker because it eliminates error due to operator inattention or fatigue and also eliminates cost of later inspection.

VARIATIONS: Similar FEDERAL Gages are available through machine tool manufacturers to change wheel feed rate to dwell grind also . . . or to control dressing cycle and finish size on I.D. grinders. When specifying machine tool requirements be sure to include Federal gaging.

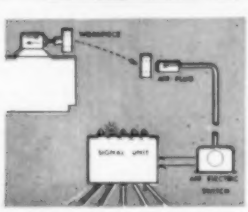


❷ AUTOMATIC 100% INSPECTION

This standardized "post-process" gage inspects every part as it is discharged from the machine and sorts work into "good", "*near*-over", "*near*-under" plus "salvage" and "scrap", indicating the size of each piece. Operator can compensate for drift and piece-to-piece variation *before any scrap parts are produced.* Can be applied to any type I.D. or O.D. grinder, lathe, boring machine or screw machine.

BENEFITS: Lower cost per part. Virtually eliminates scrap by showing trend *before* tolerance limits are reached.

Eliminates inspection errors — gage has 99.8% reliability or better.



VARIATIONS: Federal Gages of similar type are available through machine tool manufacturers to also provide automatic compensation of the machine, either proportionally or by increments, so that drift is corrected without need for operator attention. Be sure to specify Federal Gaging when buying machine tools.

❸ SEMI-AUTOMATIC, MULTIPLE DIMENSION MEASUREMENT

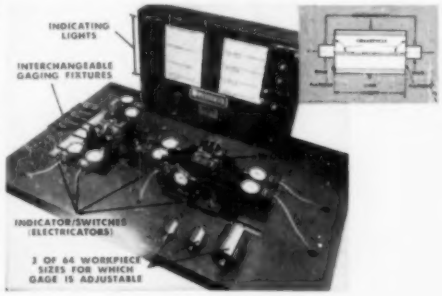
Ideal for small and medium production manufacturers, this gage checks nine dimensions in two stations and is adjustable for 64 sizes! Work is loaded and disposed of manually. Lights show "good", "over" and "under".

BENEFITS: Reduces non-productive costs—inspection time per part is reduced 75%.

Improves quality level. Permits profitable 100% inspection.

Inspection can be performed by less skilled personnel.

VARIATIONS: Can be designed to provide virtually any combination of dimensional measurements. Unit can incorporate semi-automatic disposal. Other design possibilities up to a completely automated inspection and control gage.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INTERCHANGEABLE GAGING FIXTURES
INDICATOR/SWITCHES (ELECTRICATORS)
3 OF 64 WORKPIECE SIZES FOR WHICH GAGE IS ADJUSTABLE

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